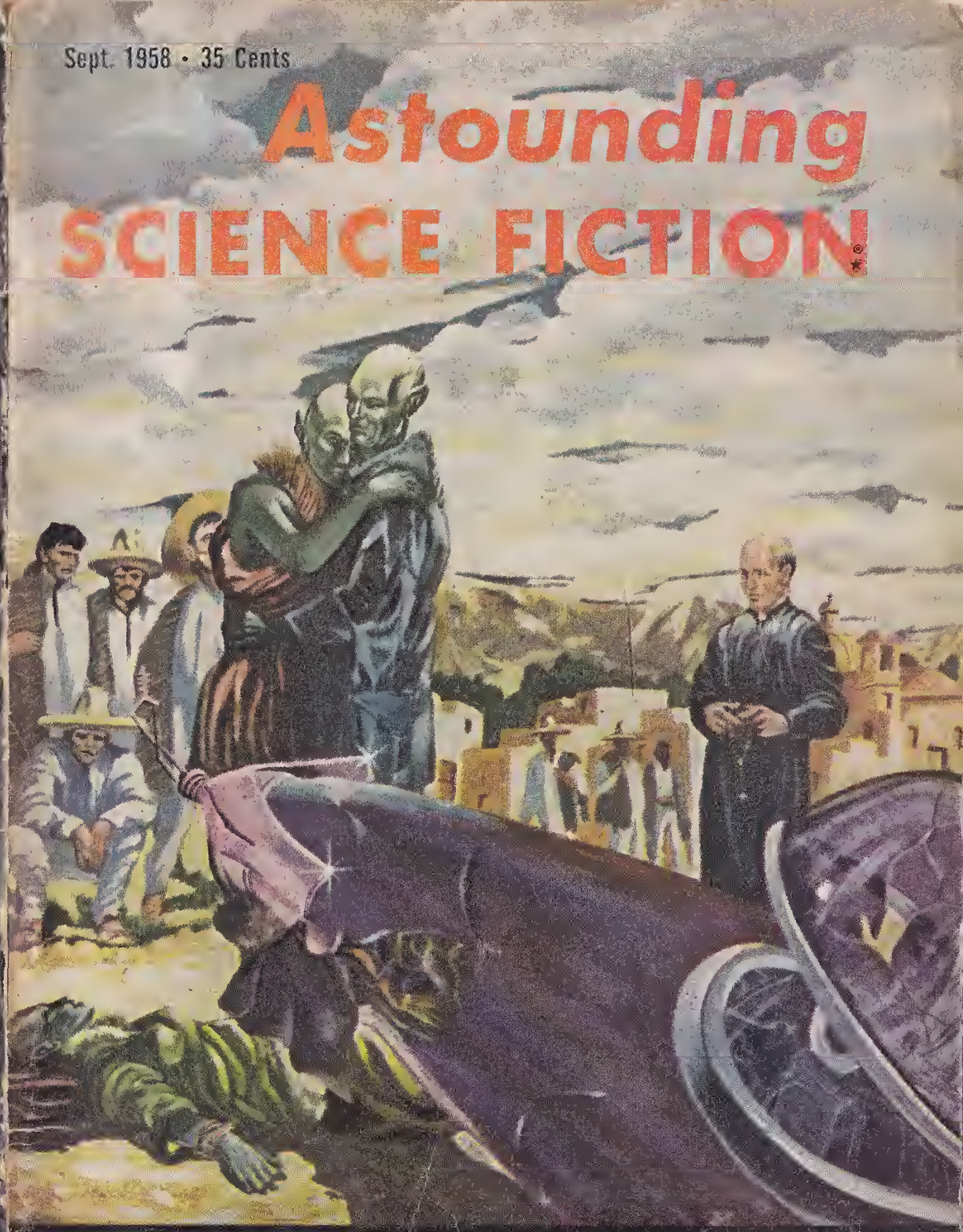
Sept. 1958 · 35 Cents

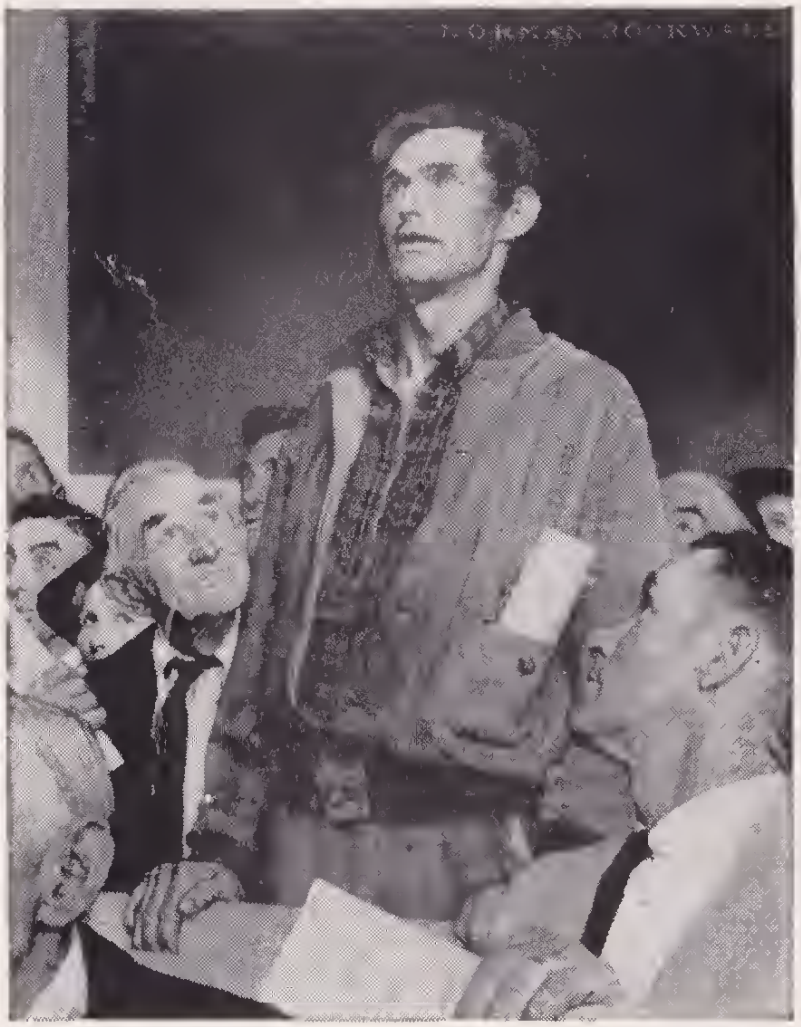
Astounding SCIENCE FICTION



COMMON PHENOMENA

STREET & SMITH'S Astounding SCIENCE FICTION SEPT. 1958

HELP US KEEP THE THINGS WORTH KEEPING



Speech is free in America. But it's not free for the *keeping!* Protecting our American heritages costs money.

Money for strength to keep the peace. Money for science and education to help make peace lasting. And money saved by individuals.

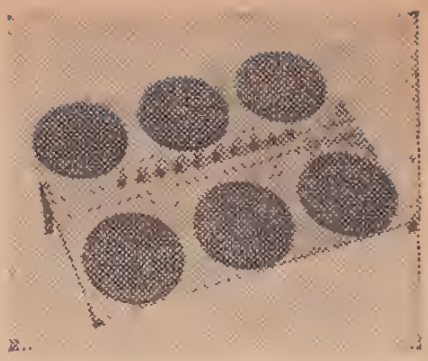
Your Savings Bonds, as a direct investment in your country, make you a Partner in strengthening America's Peace Power.

HELP STRENGTHEN AMERICA'S PEACE POWER

BUY U. S. SAVINGS BONDS

The U.S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, The Advertising Council and this magazine.

Can you think faster than this Machine?



Control Panel of GENIAC set up to do a problem in space ship engineering

Be careful before you answer. GENIAC® the first electrical brain construction kit is equipped to play tic-tac-toe, cipher and encipher codes, convert from binary to decimal, reason in syllogisms, as well as add, subtract, multiply and divide. Specific problems in a variety of fields—actuarial, policy claim settlement, physics, etc., can be set up and solved with the components. Connections are solderless and are completely explained with templates in the manual. This covers 125 circuits and shows how new ones can be designed.

You will find building and using GENIACS® a wonderful experience; one kit user wrote us: "this kit has opened up a new world of thinking to me." You actually see how computing, problem solving, and game play (tic-tac-toe, nim, etc.) can be analyzed with Boolean Algebra and the algebraic solutions transformed directly into circuit diagrams. You create from over 400 specially designed and manufactured components a machine that solves problems faster than you can express them.

Schools and colleges, teachers of science or math, engineering, philosophy or psychology will find these excellent demonstrators of circuitry solutions in symbolic logic, theory of numbers, cybernetics, and automation.

Note: Teachers take advantage of our 10% discount to educational institutions and for group purchases.

Send for your GENIAC® kit now. Only $19.95 with over four hundred components and parts, fully illustrated manual and wiring diagrams. We guarantee that if you do not want to keep GENIAC after two weeks you can return it for full refund plus shipping costs.

A MACHINE THAT PLAYS NIM

Yes, every GENIAC® comes complete with the materials and circuits for wiring up a machine that plays NIM. No extraa charge.

NEW—A MACHINE THAT COMPOSES MUSIC

Our amazing machine that composes music was designed by one of the people (a 16-year-old boy) who bought the GENIAC® to learn how to design computers. Use it to make up your own tunes automatically with the GENIAC® computer kit, 1958 Model.

Other machines you can build with your 1958 Model GENIAC® Computer Kit

Machine for a Space Ship's Airlock—Special Combination Lock—Adding, subtracting, multiplying and dividing machines—Comparing and reasoning machines—Intelligence testing machines—Uranium Shipment and the Space Pirates—Machine to play Tic-Tac-Toe—Translator from binary to decimal and dozens of others.

Some Firms and Institutions that have ordered GENIAC:

Allis-Chalmers
Remington-Rand
International Business Machines
Wheeldex Mfg. Co.
Manuel Missionary College
Los Angeles Public Schools
Kansas State University
Duke University
Coral Gables
Bell Telephone Laboratories
Walter V. Clarke Associates
Barnard College
Westinghouse Electric
Phillips Laboratories
General Insurance Co. of America
Lafayette Radio
Rohr Aircraft Co.
Albert Einstein Medical College
Naval Research Laboratories

What Comes With Your 1958 Model GENIAC?

Rack, shown in picture; parts tray; guaranteed long-lasting American Manufacture bulbs; porcelain sockets; special wipers and contacts; tools, battery; uniquely designed holder plus seven booklets and publications including: 64-page GENIAC® manual; full-length book; Minds and Machines describing computers, robots, and automation; GENIAC® Wiring Diagrams; Beginners Manual for the person who has little or no knowledge of circuits; GENIAC® Study Guide—the equivalent of a full course in computer fundamentals, lists additional readings; and exclusively in 1958 Model GENIAC® Symbolic Logic and Circuits Design by Claude Shannon.

SEND for your GENIAC® now. At only $19.95 a bargain. Comes complete with over 400 parts and components. 7 books and manuals. We guarantee that if you do not want to keep GENIAC after two weeks you can return it for full refund.

K1—Only

$19.95

(Add $1 W. of Miss $2 Outside U. S.)

OLIVER GARFIELD COMPANY, INC.

Dept. ASF-98 108 East 16th Street New York 3, N. Y.

VOL. LXII • No. 1

Astounding SCIENCE FICTION

SEPTEMBER 1958

JOHN W. CAMPBELL, JR.
Editor

KAY TARRANT
Assistant Editor

Advertising Manager: WALTER J. McBRIDE
H. A. Staab, *Art Director*

COVER BY MARTINEZ
Illustrations by Freas, Martinez and van Dongen

Astounding SCIENCE FICTION published monthly by Street & Smith Publications, Incorporated, at 575 Madison Avenue, New York 22, N. Y. Arthur Z. Gray, President; Ralph R. Whittaker, Jr., Executive Vice-President; Arthur P. Lawler, Vice-President and Secretary; Robert E. Park, Vice-President and Advertising Director; Thomas H. Kaiser, Treasurer.

Entered as second-class matter at the Post Office, New York, N. Y. Subscription $3.50 for one year and $6.00 for two years in the United States, Possessions and Canada; $4.75 for one year and $8.00 for two years in Pan American Union, Philippine Islands and Spain. Elsewhere $5.00 for one year and $8.50 for two years. When possible allow four weeks for change of address. Give old address and new address when notifying us. We cannot accept responsibility for unsolicited manuscripts or art work. Any material submitted must include return postage. All subscriptions should be addressed to Subscription Department, Street & Smith Publications, Incorporated, 304 East 45th Street, New York 17, N. Y.

Send notice of undelivered copies on Form 3579 to: Astounding Science Fiction, McCall Street, Dayton 1, Ohio.

Printed in 173 *the U. S. A.*

NEXT ISSUE ON SALE
SEPTEMBER 16, 1959

$3.50 per Year in U. S. A.
35 cents per Copy

Make over 150 Small Computing and Reasoning Machines with . . . BRAINIAC®

A BETTER ELECTRIC BRAIN CONSTRUCTION KIT

EQUALS THE ORIGINAL GENIAC® electric brain construction kit (1955) PLUS many improvements and additions: over 600 parts — including 116 improved patented wipers so that all switches work well. Instead of covering only 33 machines, BRAINIAC gives full specifications for 151 computing, reasoning, arithmetical, logical, puzzle-solving and game-playing machines . . . all 33 GENIACS (1955), 13 TYNIACS (1956), and 105 BRAINIACS (1957-58), etc.

THIS IS BRAINIAC! With our Brainiac Kit K17, you can build over 150 small electric brain machines and toys which "think," compute, reason, and display intelligent behavior. Each one works on a single flashlight battery . . . is FUN to make, FUN to use and play with, and TEACHES you something new about electrical computing and reasoning circuits. All connections with nuts and bolts—no soldering required. Originated and produced exclusively by Berkeley Enterprises, Brainiac is the result of 8 years' design and development work with miniature mechanical brains including: Geniac (see "Geniacs: Small Electric Brain Machines and How to Make Them" by Edmund C. Berkeley, 64 pp., published by Geniac Project, a partnership with Oliver Garfield discontinued September 1955), Tyniac (1956), Relay Moe (automatic relay machine playing tit-tat-toe—pictured in Life Magazine, March 19, 1956), Simon (miniature automatic digital computer with 129 relays—see "Simple Simon" by E. C. Berkeley in Scientific American, November 1, 1950), Squee (electronic robot squirrel — see "Light Sensitive Electronic Beast" by E. C. Berkeley in Radio Electronics, Dec. 1951), etc.

WHAT CAN YOU MAKE WITH BRAINIAC KIT K17? Over 150 machines including—LOGIC MACHINES: Syllogism Prover, Intelligence Test, Boolean Algebra Circuits, Douglas MacDonald's Will Analyzer, A Simple Kalin—Burkhart Logical Truth Calculator, etc. GAME-PLAYING MACHINES: Tit-Tat-Toe, Nim, Wheeled Bandit, Black Match, Sundorra 21, etc. COMPUTERS: To add, subtract, multiply or divide using decimal or binary numbers. Forty-Year Calendar, Prime Number Indicator, Money-Changing Machine, etc. CRYPTOGRAPHIC MACHINES: Coders, Decoders, Lock with 15,000,000 Combinations, etc. PUZZLE-SOLVING MACHINES: The Missionaries and the Cannibals, Age-Guessing Machine, Submarine Rescue Chamber, Daisy Petal Machine, Fox-Hen-Corn & Hired Man, Uranium Space Ship and the Space Pirates, The Three Monkeys Who Spurned Evil, General Alarm at the Fortress of Dreadreerie, etc. QUIZ MACHINES: History, geography, trigonometry, grammar, statistics, calculus, etc.

WHAT COMES WITH YOUR BRAINIAC KIT . . .

Complete Plans, Instructions, Explanations & Hardware:

- Every part needed to build Geniacs, Tyniacs, Brainiacs—over 600 pieces including control panel, multiple switch discs, jumpers, improved wipers, bulbs, sockets, washers, wire, battery and special tools.
- Complete descriptions of 151 experiments and machines.
- Over 160 circuit diagrams including 46 exact wiring templates.
- Manual "Tyniacs: Small Electric Brain Machines and How to Make Them" by Edmund C. Berkeley, 1956, 48 pages—includes Introduction to Boolean Algebra for Designing Circuits.
- "How to Go From Brainiacs and Geniacs to Automatic Computers" by Edmund C. Berkeley.
- Dr. Claude E. Shannon's historic 1938 paper given before the American Institute of Electrical Engineers: "A Symbolic Analysis of Relay and Switching Circuits," 12 pages.

only $17.95 . . . why pay more?

WHO IS EDMUND C. BERKELEY? Author of "Giant Brains or Machines That Think," Wiley, 1949, 270 pp. (13,000 copies sold); author of "Computers: Their Operation and Applications," Reinhold, 1956, 366 pp.; Editor & Publisher of the magazine, Computers and Automation; Maker and Developer of small robots; Fellow of the Society of Actuaries; Secretary (1947-53) of the Association for Computing Machinery; Designer of all the Tyniacs and Brainiacs, more than half of the 33 Geniacs (1955); Designer of the Multiple Switch Disc and other features in the 1955 Geniac kit.

BRAINIAC KIT (1958 Model) K17 . . . the kit with limitless possibilities—backed by an organization of 10 years standing in the computer field. **$17.95**

(For shipment west of Mississippi, add 80¢; outside U. S. add $1.80)

7-Day Full Refund Guarantee If Not Satisfactory

MAIL THIS COUPON

BERKELEY ENTERPRISES, Inc.
815 Washington St., R134, Newtonville 60, Mass.

Please send me Brainiac Kit K17. (Returnable in 7 days for full refund if not satisfactory—if in good condition.) I enclose $_____ in full payment.

My Name and Address are attached

"I KNOW WHAT YOU SAY..."

ORDS are simply sound-symbols for concepts; the meaning of a sound-symbol is not rigidly, unchangeably connected to a concept, so subtle change can readily set in. And usually does, of course, unless specific efforts are made to establish a solid, rigid correlation between symbol and concept. Science has made progress largely by reason of working with hard, rigid definitions, and sticking to them. That's the only way you can discover you're stuck with one—and admit the need for a change of concept.

But outside of science, the concepts sort of ooze out from under a symbol, without anyone actually admitting the change has taken place. The only way you can check, then, is to recall the old, pragmatic dictum, "I don't care what you say; what do you *do*?" Physical science has accepted rigid definitions, because physical science is one hundred per cent concerned with action-doing. An electron is a concept —but the term refers to a pattern of behavior, of *doings*.

I want to discuss a certain American sound-symbol, one that has badly slipped its moorings. Discussing the symbol is pretty useless, under such circumstances, because it can be shown that "history proves that . . ." by referring to what that sound-symbol *did* refer to. So let's set up a brand-new, nonsense word and define it in terms of action-doing. Reason: We'll have a term which, *as a term,* has no historical values whatever. We'll be forced to discuss the historical value of the action-doing system it refers to, because the term itself has no history.

Then we can, later, cross-check with the historical terms, and see how much, and in what direction, the terms have slipped.

Let's use the term "gwolic system" to refer to a particular economic philosophy. We'll define a "gwolic system" as a system under which major units of economic production are allowed to be controlled in an essentially arbitrary manner by individuals who gain their position by demonstrating unusual competence and ability. The individual executive under this system is not responsible to any higher authority for his individual decisions, but is held accountable for the over-all success or failure of his stewardship.

Under the gwolic system, the individual who shows executive competence by maintained over-all success, is automatically able to achieve the same type of arbitrary, individually-determined control over greater and greater economic units.

Mistakes he may make, causing a loss, he need not explain nor account for to anyone else, so long as his net average performance is as good or better than that of his highest-ranking competitor.

However, under the gwolic system, if his average is surpassed by a competing executive . . . he's out.

The system is, obviously, a little rugged on the individual executive; there is no guarantee of job-security, nor any reward for length of service.

But it has marked advantages from the viewpoint of the economy as a whole. It assures that the major productive units of the economy will be in the hands of individuals of exceptionally high competence. And the control is not determined on a basis of pre-determined theory or ideology, but on the harsh, pragmatic test of workability.

Further, workability is necessary, but not sufficient. If John Jones has made the economic unit under his control work, and work well . . . that's only enough to hold the job temporarily. As soon as someone comes along who can make it *more* workable, John Jones is out, and the new man is in.

Notice that the executive is free to make any arbitrary decision that he, personally, thinks is sound—and no over-riding board peering over his shoulder reviews those decisions before they're acted on. He's a dictator, free to impose his opinions on the economic unit under his control. The only limitation imposed on him is that the net result of his actions must be advantageous.

That this system would lead to high productivity, and a maximum rate of growth is fairly evident. That it would be hard on the individual executive is also obvious. It would also, of course, be hard on the individuals employed in the economic unit when the executive did make a major blunder.

So much for a definition-description of a "gwolic system."

Now what historical name does this system correspond to?

The old-fashioned Capitalistic system, of course. The executive accumulated control over a major economic unit by accumulating capital; he owned the resultant unit, and managed it on a private-decision basis, without

supervisory control. If he managed it well, on the average, his executive power was increased by further accumulation. If he slipped once or twice, he learned from the experience . . . or, if he didn't learn, he went bankrupt, and the control passed to others who could do better.

Further, if he was doing a good job, but another man came along who could do better . . . control was gradually taken from him, and the wiser executive gained.

The individual executive, under that system, was uncontrolled in so far as immediate decisions were concerned . . . but definitely controlled by loss of economic control if he continued to fall behind.

Now let's consider another type of system, one we'll call a "ngoric system." A ngoric system is characterized by committee-and-theory control of economic units. Executives are appointed, but they operate under policy established by the committee, acting on an agreed-on theory of How It Should Be. The immediate success or failure of the economic unit so controlled is not so important; the realization of the theoretical goal established is. Thus, even if one economic unit continues to function at a loss for a considerable period, it will be maintained, because the theory requires that it be done that way. Even an economic unit that does not work, cannot work, and won't ever work can be maintained under the ngoric system, because it *should* be.

The larger the scope of the committee and theory, the less workability of any one economic unit matters, and the less important competence of the executive becomes.

The ngoric system has obvious advantages; for handling long-range projects involving a long period of initiation, it is self-evidently excellent. The mammals, in essence, introduced the ngoric system, when they introduced long-term care of the young. The young are always incompetent, and an economic loss, until a very large investment of time, effort, and energy has developed them.

It's also the ngoric system that makes research laboratories possible. Governments, too, operate largely on the ngoric system.

What historical term corresponds to this defined system? The Socialistic system, of course; it is a system wherein government committees, operating under theory, appoint executives to operate economic units. The fact that an economic unit isn't producing adequately doesn't mean that anything is wrong in a socialistic system; the theory is important, not the practice. If it's a thing that *should* work, then patience, and continued subsidy is sure to make it succeed.

Of course, it's a little hard to tell whether the personnel of the project is competent; the mere fact that their project isn't getting anywhere doesn't prove anything, of course. It takes time for these things. And it *is* difficult to get satisfactory executives for Socialistic programs; so many of the highly competent individuals are so

impatient with theories, and show such poor acceptance of proper organizational procedure and discipline. They keep tending to act on their own, instead of consulting the committee before making any moves.

And now the big question: Which type of system—Capitalistic or Socialistic, does the United States have today?

Socialistic, of course. Yes, I know they *say* it's Capitalistic . . . but what do they *do?* Can a major economic unit make a move today without consulting with some series of committees? If it isn't the Securities Exchange Commission, it's the Federal Trade Commission, the Federal Communications Commission, a state Utilities Commission, or, at minimum, some Labor Committee. Congress doesn't have the power to make executive decisions for private capital companies like the American Telephone and Telegraph Company, of course. But the Department of Justice forced their subsidiary, the Bell Telephone Laboratories to renounce its rights under the Patent Law. (As it did also for IBM, and is in process of doing to RCA.) And, of course, the Federal Communications Commission rulings determine what the company executives must do. And it was long ago pointed out that "the power to tax is the power to destroy," which fact both Congress and the A.T.&T. thoroughly appreciates.

No executive of a major economic unit in this country is free to operate without half a dozen committees peering over his shoulder. No economic moves involving finance can be undertaken without *first* consulting the Securities Exchange Commission.

Meanwhile, the railroads operate almost uniformly in a state of quasi-bankruptcy. They, the only inherently efficient long-haul, heavy-duty transportation system, are being taxed and unionized into inoperable condition.

Now, on the other hand, let's see what kind of economic system the vaunted Union of Soviet Socialist Republics has.

Practically pure gwolic! Sure, the executive may be called a "commissar" instead of "owner"—but he's an executive having direct, personal authority over major economic units, held responsible for the over-all success of his unit, but not for his individual decisions toward that end.

Ah, me, how the symbols and the referent concepts do ooze around!

Soviet Russia has, in all the action-doing particulars, an almost pure Capitalistic system . . . while the Capitalistic United States has an almost pure Socialistic economy!

One thing remains true; the gwolic system, under whatever other name you put it, has historically proven, again and again, the system that gets the most real accomplishment in the least time. It worked wonderfully for the Americans, when we had it, and it seems to be doing great things for the Russians now.

It always was a good system. Too bad we gave it up.

THE EDITOR.

FOGHEAD

BY

CHRISTOPHER ANVIL

It isn't always the big things that make war tough. Sometimes it may be little things—water droplets—bugs—even little friends...

Illustrated by Freas

COLONEL Stephen Matt knew that the war was going badly. Each major battle began with Earth and her allies inferior in numbers and strength. Only a leadership that delighted in ambush, surprise, and hairbreadth timing enabled Earth to block the enemy advance. And only such a leadership could have lured Colonel Stephen Matt, bruised veteran of innumerable clashes with the enemy and his own headquarters, to volunteer for something called "detached high-level courier duty."

Matt, seated uneasily in the general's office, wondered why the general found it necessary to give a resumé of the war effort before mentioning what Matt was to do. It occurred to Matt to wonder also, just what he was to deliver, and where.

Matt watched closely as the general's pointer of light drifted through a cloud of white dots in the star model.

"Here," said the general, "our star systems and theirs are heavily fortified." He touched, with his pointer, pale silver spheres thickly packed in the far side of the star cloud. "These are the enemy's fortified star systems."

He glanced thoughtfully at Matt. "As you can see, colonel, a man would need the farsightedness of a ground mole to attack there. Each of those systems is independent, and separately supplied from the rear. Capture the nearest dozen and the hundreds behind can put up as violent a resistance as ever."

Matt nodded in agreement.

"Yes," said the general, "all these strong points need supplies." He touched a switch. A cable of bright green ran into the farthest part of the enemy's half of the star cloud, and branched out into a network of fine hairlike lines.

"This," said the general, "is the enemy's main supply route and its branches. The alternate routes are a botch of little-used and wasteful detours. If we could just get at the main trunk of this supply route—"

He swung his pointer around the star cloud, started in toward the green cable, then stopped. "But the distances in this arc are so great that the enemy has ample warning, and can move by shorter routes to block us."

The general put down his pointer.

"In brief," he said, "ordinary military measures can't win the war. Diplomatic measures can't end it, because the enemy won't make peace. We can't settle down to fight it out here forever, because the enemy's larger civilization gives him a cumulative advantage in production and manpower. We can't withdraw, because we would merely end up fighting further back and in a worse position. From the enemy's point of view, this

boils down to a happy conclusion: The humans can't win the war; they can't draw it; they can't end it—we'll crush them."

The general picked up his pointer, and touched, one-by-one, a number of widely separated stars reaching from the Terran-controlled region around the star cloud toward the green cable.

"A while back," said the general, "we discovered a means for the very rapid transmission of matter from point to point. We should be able to compound this advantage into a first-rate catastrophe for the enemy. The difficulty is, this method can't be applied to the ship as a drive. It has to be used as a station. Do you follow me?"

"I'm not sure, sir."

"The device," said the general, "will throw a ship as a radio throws the human voice. But it's no good unless there's a receiver *already set up where you want to go.*"

Matt nodded, in dawning realization of what was to come.

"We are," said the general, "quietly setting up a chain of stations. We need one more."

He touched the pointer to a lone white dot close to the thick green cable.

"When we have a station set up here, we can send a fleet through, rip that supply line wide open, seize the star systems nearby, set up more stations among them, and cut the enemy off from his base. With superior mobility, we should be able to throw him into a fog of uncertainties at the very moment when he has to hit hard and fast."

The general paused, and got control of his enthusiasm.

"However," he said, "before we can do that, *someone* has to go in there and set up the station."

He looked at Matt.

Matt looked at the little white dot behind the enemy lines.

"That," said the general, with enthusiasm, "is *your* job."

While Matt absorbed this, the general added, "We have had to make our preparations in a great hurry; but all necessary care has been used. Actually, the dangerous part will be getting there. Once you're there, everything should be comparatively simple."

He unrolled a big map and went into details.

Matt came out of the general's office with a thick set of orders in an inside pocket, and a perfectly blank expression on his face.

He walked across the close-clipped lawns, and past the neatly-trimmed hedges and borders of the Base without even seeing them. He returned salutes automatically, and when a pretty girl in a print dress stepped out of an ivy-covered arch, saw the look on his face, and brought her hand up in mock salute, he returned that, too, with a deadpan expression that left her uncertain whether to laugh or admire.

Matt was thinking that he had to find some way around a drastic shortage of time. He was to meet his crew

and lift ship in less than an hour. The planners of his flight seemed to have spared no pains in working out minute details of course and timing. But the question of the crew was another matter.

Matt showed his pass at the outer door of the Communications Building, went in, dropped his card in the slot of a soundproofed booth, and snapped on the screen. He took out a little pad, and copied a name and serial number from his orders. He dialed Personnel Director, bulled his way past lieutenants, captains, and a major, and left half-a-dozen wounded egos behind him in a little under five minutes. A lieutenant colonel decided to co-operate with him.

"Let's see, sir, you want the most recent available former commanding officer of Captain Andrew A. Decker, O-16R-73472?"

"Right," said Matt, checking the name he'd copied on the pad. "And I don't have much time."

"I'll get the calculator right on it, sir."

"Thank you."

Six or seven minutes later, a scowling colonel appeared. "What's this about Decker?"

"He's been assigned to me. I understand you've worked with him."

The colonel looked wary. "Why?"

"Did you ever have to do a tricky job, in a hurry, with a small heterogeneous crew, and an officer you've never met before?"

"Ah," said the colonel, "I understand. Well . . . Decker. He's efficient, reliable, devoted to duty, only—" The colonel hesitated.

"Yes?"

"Only— Listen, I don't know what goes on in Decker's head sometimes. Maybe the boy's a frustrated scientist. Anyway, *don't let his curiosity get stirred up.*"

Matt blinked.

"I mean it," said the colonel. "One minute everything will be going along fine. You've got a devoted officer in Decker. He's working hard. Then—blam!—a dried green beetle with yellow spots on its wings rolls out of an old report from Procristhus, or something else on that order, and there's Decker with a pin in one hand and a pocket magnifier in the other, bent over the beetle. Work's forgotten. Pretty soon, he's sketching the thing. Next he's prying up a wing. *Phew!* You can take the beetle away from him, true, but then all you've got is a shell. The boy's mind is still on the bug. The only practical thing to do is to shove him into a corner somewhere and get along without him till the fever passes."

Matt combined this item of information with what he already knew about the composition of his crew.

The colonel saw Matt's expression and added hastily, "But, aside from this, he's a fine man. An excellent officer. You can rely on him. Generally."

When Matt and the colonel were through, there was just time to send a few brief personal messages, and get to the spacefield.

At the spacefield, no time was wasted on introductions. But, in a general way, Matt met his crew.

Decker, the communications specialist, proved to be an alert-appearing officer of twenty some. He seemed courteous and intelligent, and had a glowing look of athletic good health.

The other Terran officer was a tall, wiry major, by the name of Andanelli. Matt had known Andanelli before, and noted with a smile that the major's left eyelid still drooped in a sad, knowing, cynical look.

Andanelli introduced Matt to the rest of his crew, whose names Matt remembered from his orders as:

Sttongg, Q. — Klittsman, 1st, I. K. S. F.

Battokk, D. — Klittsman, 2nd, I. K. S. F.

Klongk, X. — Klittsman, 2nd, I. K. S. F.

Rrriffuntarr — M. A. F. L. L.

Sttongg, Battokk, and Klongk each had light fur, and expressions of powerful determination on their faces. Each stood slightly under seven feet tall, and each was built with the massiveness usually reserved for armored gun turrets and doors of bank vaults. Aside from this, they looked more or less human.

Rrriffuntarr, on the other hand, had short, dark purple fur, the proportions of a saber-tooth tiger, and a highly dubious expression while glancing around at the other members of the crew.

Matt said a few suitable words, and climbed in through the hatch.

Andanelli followed, grumbling, "Well, the Kraath and the Lithian aren't at each other's throats *yet*. There's plenty of time for that, though."

Decker clambered in next, asking in a low voice, "Do they fight?"

Matt turned to see Sttongg, Battokk, and Klongk drop inside with perfect timing and grace.

After a moment, Rrriffuntarr dropped in, turned, and reached out a paw. Layers of muscle rippled under the close purple fur. The heavy hatch swung shut with a *clang*. The paw flashed out and back. The locking wheel spun tight.

Matt walked thoughtfully into the control room.

Andanelli was feeding tape into the autopilot, his long fingers reaching out to stab buttons and flip switches as he glanced from the tape to the plot-viewer.

Decker was standing by with an absorbed look. ". . . Fire hoses wouldn't split them apart?"

Andanelli glanced with a scowl at the tape, then back into the viewer. "No," he grunted, "we even spun ship, and that didn't work."

Matt slid into the control seat, glanced at the instrument console, and frowned.

"Andy," he said, "are you familiar with this model?"

Andanelli, scowling into the plot-viewer, said "Scout-cruiser, 2RC3s, sir."

"Any eccentricities?"

"None that I know of, sir. But they've got an awful thin hull. If the

countercurrents give out we may have quite a time getting her down."

"Hm-m-m," said Matt. He glanced thoughtfully at the instruments and controls, reached out and snapped a toggle switch toward him.

There was a low whine from amidships.

Matt swung a microphone around. "Ready," he warned, his voice booming in the ship. "We lift in thirty seconds." He repeated the warning in Kraath and Lithian, snapped the 'Base' switch, and said, "T. S. F. *Drake* to Base. I have twenty-three seconds till take-off. Am I clear?"

"You're clear, *Drake*."

Matt watched the chronometer needle swing up.

He heard Andanelli say, "... Eight thousand casualties, just between allies, and never saw an enemy."

The needle swung to zero..

There was a screaming whine from the countercurrent converters.

The ship lifted.

Matt maneuvered through the congested flight lanes near Base, carefully checked course and speed, and put the ship on automatic.

Andanelli was still squinting into the plot-viewer. "You know," he said, "this course breaks in and out of subspace at some tricky spots. Take this third jump, for instance. We come out near the center of mass, between the two suns of a binary star. If we're off just a hair in either direction, we could find ourselves working out the three-body problem by trial and error."

"I know," said Matt, "but it can't be helped. We'll be in enemy territory. Every time we break in or out of subspace, it'll show up on their detectors. We have to mask our movements as best we can, and that binary should be a big help."

Andanelli let his breath out in a wheeze, and punched the spacing lever on the plot viewer to get successive images of the course. "This is the trickiest layout I've seen since we almost got cooked raiding their supply base. As I remember, we called that, 'Operation Frying Pan.' "

"This is the same idea exactly," said Matt, with a faint grin. "Better to overheat the hull a little, then to get one of those monster cruisers hot on our trail."

"Only," said Andanelli, staring hard into the viewer, "this route plants us right between their teeth. Then it leaves us." He jabbed the spacing lever futilely. "How do we get out? Where are the alternate escape routes?"

"We *don't* get out," said Matt. "That's the whole point." Carefully, and in minute detail, he explained the general's plan.

Andanelli listened with wide eyes. At the end, his usual gloomy expression was replaced by a blank, considering look. "Hm-m-m," he said, and turned back to the viewer.

Matt turned and saw Decker standing just inside the door, his expression thoughtful and intent.

Beside Decker sat Rrriffuntarr, lower jaw slightly open, the pupils of its big eyes dilated in a remote gaze.

Behind Rrriffuntarr stood Sttongg, Battokk, and Klongk, their heavy brows contracted in intense concentration.

Andanelli turned from the plot-viewer with a look of awe, and said slowly, "Well, by space, it might just—"

Decker blinked and slowly straightened up. ". . . Might just *work,* at that," he concluded.

The pupils of Rrriffuntarr's eyes contracted to vertical slits. There was a low swishing sound as the dark purple tail thrashed the deck. Then Rrriffuntarr let out a hair-tingling growl of satisfaction.

Sttongg, Battokk and Klongk looked at each other with grim smiles, and nodded approval.

The autopilot let out a warning clang.

"First jump," said Andanelli.

The ship went into subspace.

The largest part of the trip went by in a series of hairbreadth escapes as the *Drake* squeaked in and out of subspace under the covering glare of giant suns. To occupy their time between breaks, Matt and Andanelli checked and rechecked their equipment, and carefully studied the details of the final landing.

"What I can't understand," said Andanelli, "is how this planet, that just happens to be ideally suited to our purpose, could be located so close to their main supply route and not be occupied."

"I know," said Matt, studying the enlarged UCF photos. "It's a strange thing. The general said he thought maybe this planet is located at an awkward distance between two other bases."

"Are we sure it really *is* Earth-type?"

"The scout ship that took these photos crash-landed on it," said Matt. He put his pencil on the wide flat top of a bluff overlooking a shelf of land near the edge of an island. "They came down here, on the flat top of this bluff, got out and worked on the ship all night and into the next morning."

"Without suits?"

"Without suits. They were afraid they'd been tracked, and wanted to get out of there as fast as they could. If they wore suits, they'd be clumsy and it would take just so much longer."

"Hm-m-m." Andanelli frowned. "All the same, it isn't natural to leave a planet unoccupied so close to your vitals."

Matt nodded. "I had the same objection. But the fact remains, they *have* left it unoccupied. If we can get down there and set up the station, it won't matter what their reason is."

Andanelli twisted around to look at the photo from another angle. "Say," he said, looking up, "why do we have to set that up on *any* planet? Why not in space? There'd be less chance of our being spotted."

Matt shook his head. "The station gives off enough radiation to show on their detectors. They'd get curious, and come out for a look. On the

planet, the radiation is masked, and we're spared that. Even if they didn't spot us right away, the fleet has to come through one ship at a time. If they caught us with only part of the fleet through, they could smash us."

"Suppose that planet weren't there?"

"Be thankful it is. Otherwise, we'd have to orbit the station around a sun."

Andanelli picked up the photographs and studied them carefully. "Well," he said, "it *looks* all right. It's too bad the UCF doesn't pick up the fine details of vegetation, and so on."

"Yes, but then every cloud, tree, and momentary patch of fog would hide permanent features of the landscape."

"True, it has its points." Andanelli put the photos back on the table. "Do we have the report of that ship? The one that crash-landed there?"

Matt slid around some papers. "Fragmentary enough." He and Andanelli read them together. After detailing a close escape from an enemy hunter-killer group, the report described the last-second destruction of one of the enemy's homing missiles, and the resulting damage to the ship, which crash-landed, on the planet, and—

". . . We almost went over the bluff. Since there was no time to lose, we ran a few quick checks on atmospheric composition while Lieutenant Smith went out in a suit and checked the damage. The atmosphere seemed all right, so we went out without suits, draped the aft section with blankets to hide the light and went to work. It was a cold foggy night but the air was breathable. The job was comparatively simple without the suits to foul us up. The only trouble was that the hit had jammed one of the retaining rings out of shape, and the whole aft section was knocked slightly askew. Everything stuck tight, and we had to jimmy and niggle the units out by inches. We didn't get through till it was starting to get light the next day. Then we got out of there fast. Time of departure was—"

"Well—" said Andanelli scowling, "apparently nothing unusual happened."

"Their medical records were checked over," said Matt. "No unusual sickness."

Andanelli's dubious look gradually cleared away. "Well," he said, glancing at the report, "you never know. That planet *could* be awkwardly located for them, and so far in their back yard that they figure there's no need for a garrison. Or, there might be some jurisdictional squabble between a couple of their generals. You never can tell."

"In any case," said Matt, "there it is." He touched the flat-looking shelf of land below the bluff where the ship had crash-landed. "We're to come down here, plant the relay on that bluff, level a spot down below, and set the receiver up under the bluff. The first ship through will be crammed with engineers and heavy

earth-moving equipment. In just a short time, we could have a sizeable base right in their back yard."

The two men went over the plans for setting up the station and studied each detail, hunting for the flaw that could hamstring them later on.

As Matt and Andanelli worked in the control room, they were vaguely conscious of noises in the aft compartment, where Sttongg, Battokk, and Klongk alternately did calisthenics and huddled in concentration over a game called "squeeze." Squeeze was played on a board with twelve squares on a side, each player starting with twenty-four men in the last two rows.

Decker was watching this game with a little black book on alien-race psychology in his hand, and an expression of stupefaction on his face. The two sides in the game quickly got jammed together in the center. Each player moved without hesitation, trying to pile up more men in one part of his line than his opponent had. When this came about, the opponent was forced back a space. However, to get more men in one place meant having fewer men in another; therefore, how—?

The game rushed on, one side grinding forward, then the other, with here and there a man next to two opposing pieces picked up, a grunt as captured men were traded—why were *those* men captured, and not others?—traded men were fed back onto the last row on the board, apparent slips, errors, and oversights took place in rapid succession, and vanished in new arrangements before Decker could figure out what had happened.

There was a low growl at Decker's elbow, where Rrriffuntarr looked at the board with obvious distaste, turned and bounded to the top of a partition, strolled with delicate balance to a narrow walk over the converter compartment, and thence to a hammock slung up there in the dimness and comparative privacy.

Meanwhile, Matt and Andanelli had finished checking details on paper, and were prying open the solidly-constructed crate of a J-bug, a small earth-moving machine that was to level a site for the receiver.

"Where," said Matt, looking around after a struggle with a crowbar, "is Decker? He might as well help us with this."

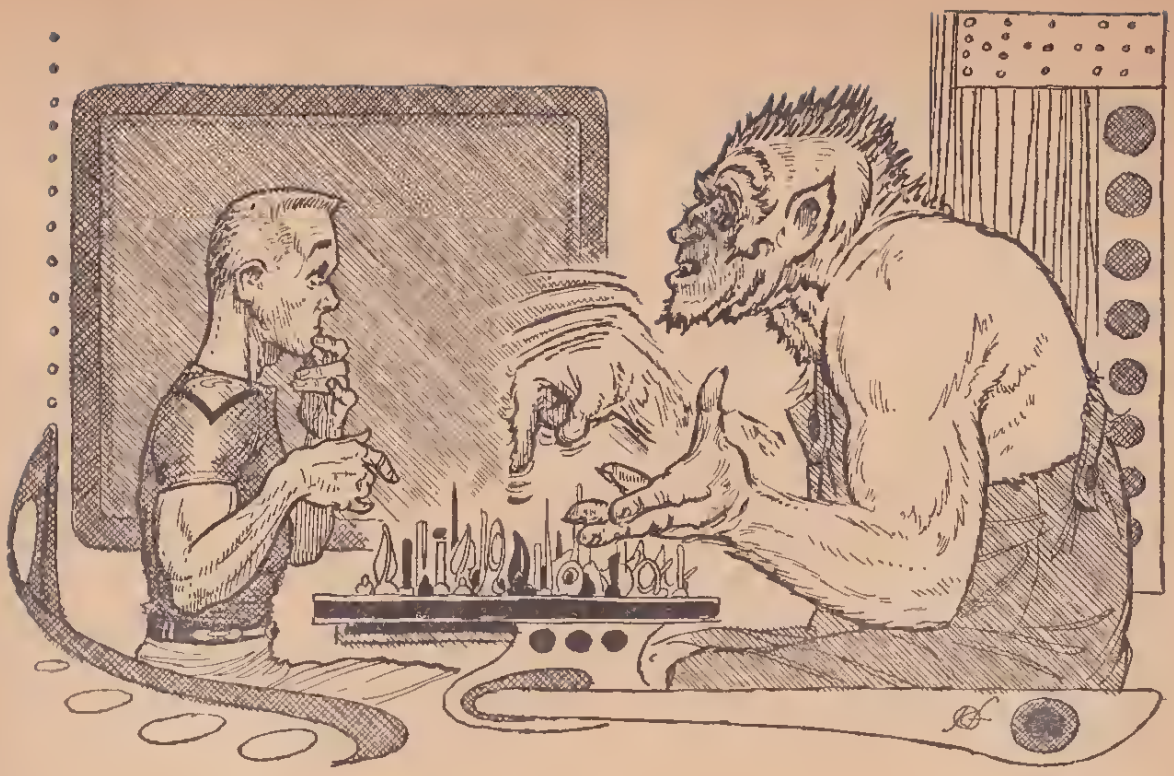
Andanelli put down a hammer and frowned. "I completely forgot Decker. I'll go get him, sir."

Decker acted as if he were eager to be helpful, but had unfortunately lost the use of his mind. He methodically hammered in a row of nails Andanelli had pulled partway out. He tripped over a projecting brace, and grabbed for support a crowbar Matt was using to pry off a strip of wood. As his two superiors glared down at him, Decker did not get up, but instead pulled from his hip pocket a small black book. Scowling in concentration, he thumbed through it.

"What," growled Andanelli, "is bothering you *now,* kid?"

Decker looked up with a frown.

"It says here, 'the ardent playing



of the squeeze game bears a functional relationship to the onset of *pratha*.' What's *pratha*?"

Matt and Andanelli stared at each other.

"Oh . . . oh," said Andanelli. "They *have* started that, haven't they?"

Matt put down his hammer.

"This will have to wait," he said.

Matt and Andanelli, with Decker looking over their shoulders, feverishly hunted through the records of the three Kraath, then looked at each other in weary disgust. Matt pulled over a pad and worked out precise calculations.

"That's great," said Andanelli, looking on. "We can't say 'yes,' and we can't say 'no.' "

"Well," said Matt grimly, "there are likely to be these little oversights when an expedition is made up in a hurry, and this one was thrown together in a desperate rush. Now we pay the price."

"But what *is* it?" said Decker. "Sir, what's *pratha*?"

Matt started painstakingly checking his figures. "Tell him," he growled.

Andanelli said, "Once a year, the Kraath have a big get-together. They play games, pick mates, and so on." Andanelli shook his head gloomily.

Decker blinked. "You mean, they're likely to go into *pratha* while we're setting up the receiver?"

"Yeah. Or sooner."

"What's so bad about that? I mean, what harm—" .

"You never saw it. They're like a drunk that isn't happy unless every-

body else is drunk. And we've got Rrriffuntarr on board."

Matt slapped down his pencil and shook his head. "Why they never learn to keep Kraath and Lithians separated—"

"But," said Decker, "if it comes around regularly, why didn't we know?"

"It hits them," said Andanelli, "in spring on the planet of their birth. They've got more than one home planet; spring comes at different times depending on the home planet, and on whether they live in the northern or southern hemisphere. To make it worse, their years are different lengths, so *pratha* can come any time on our calendar. But the real trouble is, nobody at headquarters knows what it's like unless he's been through it."

"With," said Matt, "a Lithian around."

"Why?" said Decker.

Andanelli groaned.

Matt said, "Can you picture Rrriffuntarr happily playing squeeze with Klongk, and then singing songs all night with Sttongg and Battokk, while Klongk whacks him on the back every few minutes?"

Decker stared off into the distance. "No," he said finally, "I can't."

"That's it," said Matt. "Rrriffuntarr wants peace and quiet. Klongk, Sttongg and Battokk want everybody happy. Once that combination gets going, there's nothing to do but dive for the shelters."

"I see it now," said Decker, looking a little awed.

Andanelli glanced around gloomily. "It's a small ship. I hope we make planetfall before it starts."

Matt got up suddenly. "We'd better check that J-bug."

This time, Decker was a help as they ripped open the crate.

Close inspection showed the J-bug to be in good shape. The same seemed to hold true of the rest of the equipment. Everything appeared to have been arranged with forethought. Except that now the three Kraath had taken to singing songs in the evening. Their voices were deep and loud, with a dull booming quality such as might have been expected of giant bullfrogs.

The overall effect was like listening to an orchestra made up entirely of bass drums.

Matt was totally immersed in the effort to find a short cut. The chance, he knew, was small, but it might save the situation if he could. He was checking an unlikely long jump when something jostled his elbow.

Matt looked up to see a massive purple flank. Rrriffuntarr was sitting next to him, back to the wall, eyes glittering in the direction of the booming Kraath trio.

"R'r'r'r'r," said Rrriffuntarr.

"It's a miserable noise all right," said Matt, speaking Lithian.

"R'r'r'r. *R'r'r'r'r'r*," said Rrriffuntarr, angrily.

Matt forgot about the short cut. The situation wasn't going to hold together that long. Rrriffuntarr was now growling steadily, a monotonous

rumble that rose and fell, thick with menace.

Andanelli was standing by the doorway with his eyes shut, and his lips moving, as if in prayer.

Decker came in, saw Rrriffuntarr, and took a hasty step out of the way.

The growl was slowly rising to a threatening whine, a noise that cut at the eardrums as harshly as the Kraath singing battered at them.

Abruptly, Matt had an idea.

Matt spoke loudly, his voice rasping and snapping in angry Lithian. "Here we sit, with that noise blasting us out of our senses, and the outlanders are too drugged to see reason. I can't take much more of this racket."

"Neither can I," snarled Rrriffuntarr.

Andanelli squinted hard. "Nor me either," he said.

"But," said Matt forcefully, "if we rip them up to end this awful noise, it wrecks our chance to win the war."

Rrriffuntarr let out a roar of frustration and rage.

From the other room came a new tune—a choppy, booming noise like a forest of hollow trees attacked by woodpeckers.

"Aieeow!" cried Rrriffuntarr.

"Quick!" yelled Matt. "We can't stand it! We can't end it! Let's howl them down—*War by voice*!"

Rrriffuntarr's glittering eyes widened, narrowed. The huge chest expanded. Rrriffuntarr's sharp-fanged mouth opened wide. There was a high, wavering siren noise like the crash horn at a spaceport.

Rrriffuntarr, eyes shut and head tilted, braced all four legs and cast around with a cutting screech that sawed at the Terrans' nerves, and left them with eyes shut, hands pressed to their ears, and a sensation of dancing spots in their heads.

Time hung suspended.

The terrible noise stopped.

Matt blinked, and suddenly spun to scribble rapidly on a pad.

From the other part of the ship came total silence.

Rrriffuntarr's head was cocked attentively on one side, listening.

Decker stepped into the corridor and called out, "We want to join your singing. Is that all right?"

"*Andy,*" said Matt hurriedly, "come here and help me check this."

From the other end of the ship came a hollow voice: "Pratha time is not yet."

Andanelli bent over Matt's figures, and sucked in his breath sharply.

Decker translated to Rrriffuntarr, who gave a sort of grin and lay down on the deck, tail thrashing.

"You've *got* it," said Andanelli. "That'll get us there well ahead of time."

"It came to me," said Matt, "just as Rrriffuntarr hit that high note."

There was noise nearby like a big engine running slowly.

Matt and Andanelli looked down.

Rrriffuntarr was purring.

The two men began to tape the new course.

Matt spent the last part of the trip explaining every detail about the

landing and setting up the receiver to the Kraath and Rrriffuntarr. The three Kraath absorbed the information with relentless concentration. If a point was not clear to them the first time, the second time, or the tenth time, they were prepared to hold their minds fixed on it indefinitely, till finally they understood.

Rrriffuntarr, on the other hand, appeared to approach problems by indirection, tentatively testing out first one angle of attack, then another, and seemingly getting nowhere till—*pounce!*—suddenly the answer was clear.

Matt had to admit that both methods seemed to work. As the time approached to make the landing, he was well satisfied that everyone understood what had to be done, and—so far as possible—why.

Now if they could just make planetfall before Sttongg, Battokk, and Klongk went into *pratha* and had a war with Rrriffuntarr. Already, the three Kraath had taken to singing songs in low voices—a sound like the distant thumping of cannibal drums. Rrriffuntarr was wandering around, sitting down first here, then there, muttering low growls, tail thrashing, and claws sliding out to bunch the thin plastic sheeting over the steel deck.

Andanelli came in tense-faced. "They're playing that game all the time, now."

Matt glanced at the chronometer. "We break out of subspace in about twenty minutes."

He repeated in Lithian for the benefit of Rrriffuntarr, who got up and began pacing back and forth, tail twitching spasmodically.

The twenty minutes till break-out passed like a leisurely eternity. Decker went in to ask the Kraath to please sing in lower voices, and did not come back. Andanelli went to check up, and reported that Decker had been trapped into a game with Sttongg. Soon, Decker's voice drifted out, complaining, "Why *shouldn't* I take that man? What's the *point,* anyway?" Sttongg's voice could be heard, urging, "Move! Move!" This set off a Kraath song of innumerable tunes and only five words: "Move! *Move!* This is *life*!" This was sung, first slow, then fast; first low, then loud; it was crooned and chanted; sung smoothly, then with a hammering intonation.

Rrriffuntarr lay down with a groan, tail stretched out straight and limp, forepaws clutched over forehead.

Andanelli stared uneasily at the Lithian. Matt tensely watched the chronometer.

Finally the autopilot gave a sharp clang.

"Thank God," said Andanelli.

The ship came out of subspace in the overpowering glare of a sun.

Matt hastily checked his instruments, scanned for the planet by UCF, and hurled the ship away from the sun.

The three Kraath came out of *pratha* long enough to help get the tiny signal satellite into its agonizingly precise orbit. Then Matt dropped

the ship toward the planet. Everyone crowded behind, watching the screen.

The UCF showed the contours of the ground clearly, unobscured by clouds or vegetation. Matt watched as a leaden sea swung up heavily below them. Then a number of islands came into view; two faced each other with wide, flat-topped bluffs overlooking shelves of low land bordering a narrow strait.

Matt snapped a switch, and the projected image of the UCF photo he and Andanelli had looked over appeared on the screen. Matt turned a knob to enlarge it, then spun the image slowly around. The outlines of photo and direct UCF reception matched.

Matt slowed the ship and began to drop.

There was no sign of an enemy base down below. Still, Matt thought, it was impossible to know for sure. He became aware of the crowd behind him.

"O.K.," he said. "Everyone to his station."

There was the thud of big feet, the scratch of claws, then a rumble as the turrets of the ship slid open their covers.

Matt threw the recording switch, then kept his eyes on the UCF screen as the ship dropped fast down the side of the bluff.

Decker's voice came to him, sounding a little dubious: "Nose turret ready." One by one, the others reported in, each voice registering uncertainty.

Matt swung the UCF rapidly. No sign of trouble. A lucky thing, he thought. The friction between the Kraath and Rrriffuntarr had already drained their energy. It would, Matt thought, be good to get out in the open again on an earth-type planet, free of the restraint of life in the confined space of the ship.

The UCF spun around again, to show the face of the bluff, flowing up as the ship dropped to a landing. What appeared to be layers of rock, showing an odd weathering effect, rose into view. Matt stopped the turning of the UCF, and said, "Decker—"

"Sir?"

"How does that bluff look to you? Is that rock?"

"Rock? The . . . what? . . . you said, sir?"

"The bluff," said Matt, frowning. "I want to check your impression against what I see on the UCF. Is that weathered rock on the bluff?"

Something appeared momentarily on the screen, a small gray blur against the background of the bluff.

"Sir," said Decker nervously, "all I can see is a dark grayness. We seem to be inside a pretty thick cloud, sir."

The ship settled gently. Matt frowned, checked his instruments, then reached out to snap off the converters.

A section of the screen about two inches across showed a pattern like that of the ripples when a pebble is dropped in still water. The pattern oscillated rapidly, then blurred to a solid gray blot on the screen.

Matt, one hand still on the converter switch, swung the UCF back and forth. The blur moved back and forth with it.

"Can anyone see anything?" he asked.

"Not I," growled Rrriffuntarr.

"No, sir," said the Kraath.

Andanelli said, "Sir, I thought this was a cloud, too, at first. But this is too dense for any cloud I ever saw. And there *seems* to be some kind of layer—"

Decker said, "I see that, too, now. But it wasn't there before."

Andanelli's voice grated. "There seems to be some kind of layer on the outer surface of this turret. Sir, I wonder if they've got a coat of sunscreen on these turrets?"

Matt, thinking fast, recalled that the other ship, that had crashed here, had stayed a full night without mention of any deposit that had formed on it. And it would be just like a hurried official to order a coat of sunscreen after a quick glance at the route.

Matt snapped off the converters.

Three widely-separated sections of the screen, each about two inches across, showed an oscillating ripple pattern that blurred to a blot of gray.

"Decker," said Matt, "get down here!"

There was a clang, and a rush of feet. *"Sir?"*

"What's happening to this screen?"

Decker bent over Matt's shoulder. He reached down to swing the UCF. On the screen, the four blots traveled back and forth.

"Sir," said Decker, in a puzzled voice, "I don't know. Maybe a meteor when we—"

"Meteor, nothing," said Matt sharply, "this has happened since we came down."

"Then I don't know, sir," said Decker.

Matt raised the UCF slowly, studying the cliff. What had looked like layers of weathered rock now seemed too regular for normal weathering.

Matt asked, "Could bullets cause those blurs?"

"They might, sir. I don't know, for sure."

Matt looked up. "You're the communications officer. Would they, or wouldn't they?"

Decker hesitated. "I *think* so, sir."

Matt clamped his jaw, and snapped the audio receptor switch. There was a hum as the detector rose out of its well. Matt put on the earphones, heard a buzzing noise and a slow dripping sound.

There was an especially loud buzz, and on the screen a gray blur, an oscillation, and another blank blot.

The overall buzz seemed to grow louder.

Matt turned the UCF slowly. The bluff swung past, and there was the shelf, sloping to the choppy gray of the sea. Matt stiffened; the shelf of land had looked flat enough in the photo. Now that they were here, it was plain to be seen that it had a definite tilt.

The slanting shelf swung past.

Matt had a view of the sea, and of another shelf and bluff on an island about half a mile away.

There was a loud droning buzz in the earphones, and in the background, a steady *drip-drip, drip-drip.*

Their own bluff swung back into view, there was another loud droning noise, the sounds faded and swelled, then two more gray blots appeared on the screen. Matt tilted the viewing angle to look high up, heard another buzz, discovered another blot, and swiftly tilted the viewing angle down. The nose of the ship, seen from behind, appeared on the screen, then slid out of range as the big detector grid swung face down. Then the screen went blank as Matt lowered the grid tightly into its well.

The dripping sound had stopped; but the droning noise remained. Matt took off the earphones, called Andanelli in for a quick summary of the situation, and checked the atmosphere. Everything looked fine, till Matt noticed the water content; he scowled, and ran another check. Still scowling, he called to Decker to get out a couple of suits.

Andanelli stayed in charge inside. Matt and Decker struggled into the bulky suits, then clambered into the air lock.

Once inside, Matt swung around, reached out for the inner door, and locked it shut. He turned around, saw the equipment locker, and spoke into the transceiver. "Hear me, Decker?"

"Yes, sir."

"Andy?"

"Here, sir."

Matt crossed to the equipment locker, and got out a coil of rope. He carefully fastened one end around a cleat at one side of the outer hatch, spun the lock wheel, and said, "Air-lock screen working all right?"

"Yes, sir," said Andanelli. "I see you perfectly."

The lock wheel spun as far as it would go. Matt took hold of the door handle.

Carefully, he pulled the air lock open.

A thick gray blankness looked in at him.

He stood stock-still, then leaned out to look down.

He couldn't see the ground.

Matt got a heavy wrench from the locker, tied it on the end of the rope, leaned out, and lowered it like a seaman sounding for bottom. He faintly felt the rope touch, and raised it and lowered it several times to be sure. There was a peculiar springiness when the rope touched. Matt straightened up and turned to look around.

There was a hazy bulk beside him that he realized was Decker. The outlines of the space-lock door were fuzzy and vague. The whole inside of the air lock was gray and indistinct.

Matt said, "Andy?"

"Sir?"

"How's it look on the screen?"

"Like we're underwater off the mouth of a muddy river."

Matt leaned far out and slowly turned to look all around.

He saw grayness in all directions.

He pulled himself back inside, saw the murky blob that was the locker, crossed to it and took out a powerful handbeam. He went back to the hatch, aimed the beam out the door, and flipped the switch.

The light reached out, lit a length of fog, and seemed to come to an end several yards away. Matt swallowed, squinted, leaned out, and swung the beam down. He could make out a vague greenish color, but no details.

Matt said, "Decker."

"Sir?" said Decker's voice from the earphones.

"I'm going to climb down there. Hold this light, and hand it down to me when I ask for it."

"Yes, sir."

Matt took hold of the rope, started to get out, and realized that the rope hung from the cleat in a supremely awkward position. The cleat was at the side of the hatch. The rope ran straight to the edge of the hatch, bent around the lip of metal, then dropped straight down. To climb down, it was necessary to somehow brace both legs against the curving sides of the ship, and hold the rope up and out to get hold of it. From this position, one might confidently expect to slip, drop, and get both hands jammed against the side of the ship.

Irritated, Matt stepped back and glanced above the door. If there were a cleat there, the rope would hang down where he could get hold of it.

There was no cleat there. He felt outside. The ship was perfectly smooth.

"I think," said Matt, "that I just found the little detail we were afraid of."

Andanelli's voice said, "I completely forgot that. Along with the thin hull, that's another failing of this boat. To hang the rope so a man can get out in a suit under gravity is something they overlooked."

"Where do they keep the ladder?"

"In the storage. It's collapsible. You want me to get it?"

"No. Wait." Matt studied the rope. Suppose he took it, looped it under, and then over, the big hinge of the outer hatch. He was about to try it when Decker said, "Sir, I think I can do it."

"You see a way?"

"I think so, sir."

"Go ahead." Matt stepped back, frowning.

Decker went to the hatch, took the rope, passed it over his shoulder, climbed up in the hatchway, facing out, clumsily started to face in, got the rope down in his hands, and leaned far out, bracing himself with his feet—

Matt caught his breath. "Careful," he said, "the fog may have made it slippery."

"I'm all right," said Decker cheerfully. He leaned almost straight out into the gloom, and started to inch his way down.

Faintly, through the suit, Matt heard something go, *"Z'z'z'z."*

There was a sharp *whack* against his faceplate.

Decker made a sound like a man jabbed in the stomach. His suit twisted sidewise, jerked in toward the ship, slammed into it with a rough indrawing of breath in the earphones, then dropped out of sight.

Matt called sharply, *"Decker!"*

There was no answer.

Andanelli said in a tense voice, "Want help?"

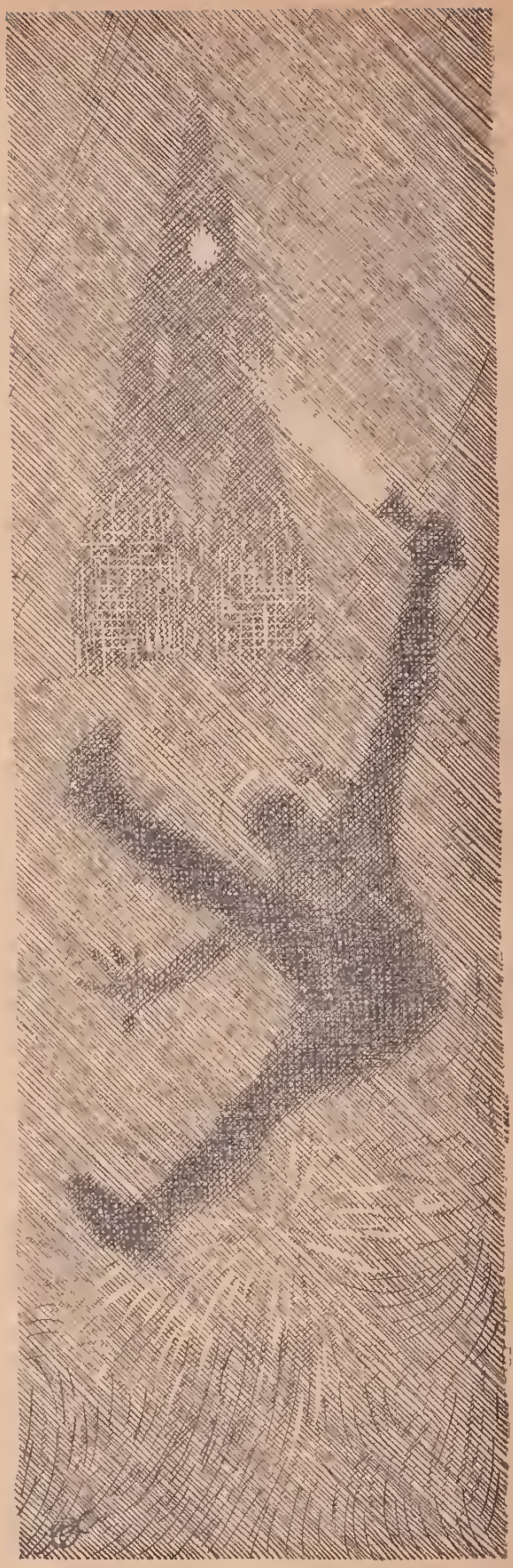
"Not yet. Have Rrriffuntarr suit up."

"Yes, sir."

Matt shone the light down, and saw nothing but grayness and a vague tinge of green. He gently tugged the rope. It came without resistance. Matt pulled in a loop, passed it over the open hatch, so it hung from the big hinge. He picked up the handbeam and discovered that it had no attachment to fasten it to his suit.

He yanked up the rope, untied the wrench, tied the handbeam on the end, and let it down. Carefully, he clambered up into the hatchway, every movement made clumsy by the suit, took hold of the rope, swung loose, started to slip, and got a loop of the rope around his leg. The rope slipped, and the bulge of the ship ground his hands. He tried to hold the loop against his ankle with his heel, pressed in against the ship, and slid his hands down. Then he tried to slide down farther, and discovered that the rope had jammed tight around his leg.

Owing to the thick fog, Matt could not see how the rope was caught, and



because of the bulky suit, he couldn't feel how it was caught. But if he didn't get it loose, he would eventually lose his grip and swing upside down, with a good chance of smashing his skull in the process.

There ensued a methodical but increasingly violent struggle, with buzzing things regularly whacking Matt on the faceplate, with his knuckles grinding against the ship, and every muscle aching, and which finally ended when he had almost given up, and then the rope came loose.

He dropped down the rope, his feet hit ground and slid greasily out in front of him.

Matt pulled in the light and snapped it on.

There was no sign of Decker.

Matt said, "I don't see Decker anywhere. What about Rrriffuntarr—in his suit yet?"

"Yes, sir."

"Just between the two of us, is his style of suit as bad for him as ours is for us?"

"From the looks of it, sir, it's worse."

"Well— Use the remote arms, and haul the rope in. Shut the hatch and disinfect the air lock."

"Sir, the ship that crash-landed didn't have any trouble with sickness."

"No, but what they reported and what we've experienced so far bear no relationship whatever to each other. After you've got the air lock cleaned out, send Rrriffuntarr in with the ladder. Have him come down here with another light and about two hundred feet of rope."

"Yes, sir."

Matt felt the rope move, and remembered the light was still tied to the end of it. "Hold it," he said.

"Sir?" The roped stopped moving.

"Just another little detail," said Matt, and untied the light. "O.K., pull in the rope."

The rope went up. Matt shone the light carefully around. He saw a foot-thick layer of pale green plants that spiraled up in a mass of interlocked stalks. Near his arm, a thin spike reached up out of sight in the fog. Matt shone the light on the spiraling stalks, then reached out. Between his fingers, the stalks felt as slippery as if they were greased.

Matt got very carefully to his feet, and shone the fuzzy beam of light around. He saw no sign of Decker. He thought that if Decker had slid in the greasy stalks, or stumbled off dazed, he should have left *some* track. But there was no track that Matt could see.

Matt said, *"Decker?"*

There was silence. Then in his earphones, a voice said weakly, "Sir?"

"Decker?"

"Yes, sir." The voice sounded more humble than injured. "I'm sorry, sir. I thought I could do it. But something banged me in the faceplate. It startled me, and I lost my balance."

"Oh. Well, don't worry about that. How do you feel?"

"A little beat-up, sir. But I don't think anything's broken."

"Good." Matt snapped on the light, and said, "Do you see any light, Decker."

"Light? No, sir, I don't."

"Look all around."

"No, sir, I . . . *unh!*"

"What is it?"

"Nothing. I just seem to be in the water, that's all. I can't seem to"—the voice had a trace of panic—"get up to dry ground. My feet slip—"

"Can you stay where you are?"

"Sir, in this fog, I can't tell. I seem to be sliding."

"Can you get hold of a handful of grass?"

"I—" There was a grunt, then a sigh of relief. "Yes, sir. I've got it. But I'm not sure which way is toward land."

"Don't worry about it. The suit can stand a little water. Just stay where you are and keep a good grip on that grass. If it's like what there is around me, it's greasy."

"I stretched it out and wrapped three or four lengths around my fist."

"Good. How did you get down so far?"

"I don't know, sir. I was out cold."

"Well," said Matt, "it doesn't matter. We'll get you out when Rrriffuntarr—" Something seemed to slide under Matt's feet. Both legs shot out in front of him. He tried to break his fall with one hand, and clung to the handbeam with the other.

He landed springily, and slid.

He slid as if he were shooting down a steep slope.

There was a splash.

His legs floated.

Holding the light out of the water, Matt twisted and grabbed a handful of grass.

He knelt in the water, and shone the light down.

The grass under him was moving in long waves, as if trying to push him farther out to sea.

"Sir," came Decker's voice, *"now* I can see the light!"

Matt shone the light around.

A hazy form was about a dozen feet away, bent over in the fog and water. Matt realized that this was Decker, clinging to *his* handful of grass.

Matt shone the fuzzy light up the slope.

The whole mass of grass seemed to be moving in slow waves running down the slope.

Andanelli's voice said, "Sir, Rrriffuntarr's ready to come out."

Matt said in Lithian, "Can you hear me, Rrriffuntarr?"

Rrriffuntarr's voice, weirdly distorted by the Lithian processes of suit manufacture, hissed, "Yess, but not clearly."

"Where are you?"

"Sstanding by the hatch."

"Have you got the ladder down?"

"No. I am trying to sssnap it open."

Matt scowled, *"Andanelli."*

"Sir, I showed him how it works."

Rrriffuntarr snarled, "The faceplate of thiss suit ssteams up."

The grass under Matt began to heave up and down violently, so that

he sloshed back and forth in the water.

Matt grunted, "take your time, Rrriffuntarr. It won't do any good to rush."

Rrriffuntarr let out a muffled noise like a string of firecrackers going off at a distance.

"Andy," said Matt, "see if you can't help him."

"Yes, sir. Rrriffuntarr, if you'll turn to one side, so I can see—"

A hissing noise came through the earphones.

Decker's voice said, "Sir, maybe we could work a little farther up. With the light, we can see a little. If we grab hold farther up before we let go with the other hand—"

"That's fine," said Matt. "With one hand, I hang onto the grass, with one hand I hold the handbeam, and with the other hand I reach out and take a new hold. You go ahead, if you want to. I intend to hang onto this light."

Andanelli began giving Rrriffuntarr detailed instructions in unfolding the ladder. This involved as many aggravations and delays as if Rrriffuntarr were blindfolded and Andanelli handcuffed.

The grass surged up and down, backwards, forwards, and sideways. Matt hung on grimly.

Rrriffuntarr let out a violent string of oaths.

Andanelli made soothing sounds and repeated his instructions.

Decker gasped, "Sir, *where is this stuff trying to take us?"*

"Z'z'z'z!" Something buzzed around, and whacked Matt's faceplate.

"Don't worry about that," said Matt. "Just hang on."

The buzzing faded.

"Unh!" said Decker. "Yes, sir."

A lengthy stretch of time dragged by.

Rrrinffuntarr swore. Andanelli groaned and repeated his instructions. Decker tried out loud to guess what lay out under the water where the grass was trying to sweep them. The buzzing whine droned around their heads and banged them in the faceplates. The grass relaxed as if to throw them off guard, and then surged violently. The water splashed, gurgled, and sloshed them back and forth. The thick gray fog seemed to grow steadily thicker.

The general's comment repeated itself in Matt's head: "The dangerous part will be getting there. Once you're there, everything should be comparatively simple."

Somewhere in the background, Matt could hear in his earphones the three Kraath starting to sing.

At length, Rrriffuntarr let out a hideous oath, and announced that the ladder was in place. "Now . . . what mussst I do to get to you?"

"Tie one end of your rope to the ship," said Matt. "Tie the other end around you. Climb down and stand ten feet or so away from the ship." He added dryly, "You'll get here fast enough."

Rrriffuntarr could be heard climbing down the ladder. There was a

brief silence, then the sound of breath sharply expelled.

Matt snapped on his light.

A writhing figure shot toward them, trailing a rope. There was a mighty splash.

"Now," said Matt, "grab a handful of that grass, and work your way toward me."

Twenty minutes later, they were climbing the ladder back into the ship.

After a brief interval made agonizing by the noise of the Kraath singing, Matt sent the Kraath out with an extra length of rope, weapons, and a powerful light on a cable.

Rrriffuntarr climbed dripping wet out of the Lithian spacesuit, and fell into an exhausted sleep.

Decker, who looked as if he had been thrown down a mile-long staircase in a barrel, immediately became curious about the defective Lithian suit. Signs of weariness vanished as he bent over the suit in intense concentration.

Matt checked to see that everything was under control, then lay down for a little rest. He shut his eyes, fell asleep, and someone was gently but persistently shaking him.

"Sir," said Andanelli, "we're in a mess."

Matt sat up. He felt sore, stiff, and drugged with fatigue. "*Now* what?" he said, and the words came out like a challenge to a duel.

Andanelli hesitated. "Well, sir . . . ah—" He held up a bottle. "We found this in the air lock, sir."

Matt looked at a thing about the size of the first joint of a man's little finger. The thing was gray, was lying in a pool of cloudy liquid, and had several broken filaments thrust up from what appeared to be a coat of thick bristly fuzz.

"Sir," said Andanelli, "I think that's what banged you and Decker on the faceplates."

Matt frowned.

Andanelli added, "I couldn't find any eyes on it at all." He said this in the apologetic tone of one who does not want to tell all his bad news till he sees how the first item is taken.

Matt looked at the thing wonderingly. Then realization hit him.

"I figure," said Andanelli carefully, "that it doesn't have eyes because . . . you know . . . like fish in an underground cave where it never gets light—"

Matt swung his feet to the deck and started for the control room.

Decker was on the floor, rows of neatly-arranged parts spread out around him.

"You think," said Matt, "the fog here *never* lifts?"

"At least," said Andanelli cautiously, "not during the season when these things are out."

Matt glanced at all the work spread out around Decker. Matt realized he must have been sleep far longer than he had thought. "What about these bugs? Do you think they see like bats, with echoes, is that it?"

"Well . . . yes, sir, for one thing. And I've studied the UCF records we made when we came down. What

looked like weathering on those bluffs is too regular for that. Sir, what if these things have a crowded colony of nests over there. Where the rocks weathered, they might eat in, and . . . the echo from your faceplate maybe sounded more promising—"

Matt said sharply, "What are you leading up to?"

Wordlessly, Andanelli handed Matt the outside audio receptor earphones. Matt raised them to his ears.

Z'z'z'z'z'Z'Z'Z'z'z'Z'Z'Z'Z'Z

The droning was like hives of swarming bees.

"It's even possible," said Andanelli, "as if it were a matter of only academic interest, "that they build outer nests of light tough fibrous material, like hornets; and of course, if they nested in the UCF, that might explain the blurring."

Matt glanced at the screen, which was blank, and thought a moment. Andanelli must have called him for something more pressing than this. Let's see: Hornets nest in low limbs of trees, and under the eaves of houses; bees nest in hollow—"Is the outer door of the air lock open?" said Matt suddenly.

"Yes, sir," said Andanelli, poised like a man in a canoe, with the rapids roaring just ahead.

Matt said sharply, "Can't you close it?"

"No, sir. They've already built in there."

"What about the remote-control arms?"

"They won't move, sir."

"Are the Kraath still outside?"

"Yes, sir. I already tried to have them close it. The bugs drove them away."

"You mean, *they sting through the suits?*"

"No, sir. They squirt a corrosive liquid. It eats holes through the suits."

Matt stood perfectly still. "Where are the Kraath now?"

"Out in the water hanging onto the weeds with one hand."

"We can't have that air lock blocked off. Have you tried the disinfectant spray?"

"Yes, sir. They seem to have the nozzles sealed off."

Matt snapped on the air-lock viewscreen. The screen was black, with an occasional flickering of light.

Matt visualized the situation, and stood wrestling with the alternatives.

Decker chose this moment to let out a triumphant yell. "I've got it!"

Andanelli looked at Decker severely.

"Sir," said Decker, turning around, "this train of little parts doesn't have enough free play. Sir, every time, somewhere along the line, it seizes." He hammered the steel deck beside it, "Vibration loosens it. Or, maybe if I—" Decker's eyes focused on the mechanism, and he stopped talking.

"Gone again," said Andanelli. "I've seen people who couldn't hold their minds on anything for five minutes, and I've seen people who kept their minds on something so long nothing else seemed to matter. But

here we have an example of the hoptoad mind with the bulldog grip."

"Let him work on it," said Matt. "Rrriffuntarr can work a lot better if his suit's fixed."

"Sir," said Andanelli hurriedly, and with signs of strain in his voice, "there's something else I think I ought to mention about Rrriffuntarr—"

"Now what?"

"Sir, Lithians are pretty enigmatic about some things, and so are their records. I've noticed Rrriffuntarr has seemed to eat quite a lot lately, and seemed to tire pretty fast in that suit . . . of course, it's a bum suit, but—Sir, I was on a ship once where one of the Lithians had cubs. Those cubs can pretty nearly take a ship apart in a single afternoon, and—"

Matt blinked, "Slow down a minute. What reason do we have—"

"Sir, it fits right in with everything else. And the only way I know to tell a Lithian male from a Lithian female is to ask another Lithian. Ask them direct and they take your head off. Sir, I can't forget that awful trip with those cubs—"

Matt looked at Andanelli the way one looks at a trusted associate who has, unfortunately, been exposed to a little too much nervous strain lately. "Well, Andy," said Matt, "let's not worry about that right now. We can figure that out later. Right now, let's get the Kraath inside."

Andanelli seemed to struggle to get hold of himself. "Yes, sir," he said finally, and relaxed a little. "But, sir, if we make a hole anywhere, the bugs will come in and make a nest out of the whole ship."

"The first thing to do," said Matt, "is to make sure everything that should be is strapped in place."

After checking the ship, warning Rrriffuntarr, telling the Kraath what he was going to do, and helping Decker put the spacesuit parts in labeled boxes, Matt slid into the control seat and snapped on the converters.

Slowly and gingerly, the ship lifted. The whine of the converters was lost in a heavy threatening buzz.

"The bugs," said Andanelli. "They don't want their nests moved."

Rrriffuntarr came in, eyes large and glittering, and fur on end.

Andanelli said in Lithian, "It's O.K. Just some bugs that have built their nests on the ship.

Rrriffuntarr silently raised one forepaw. This paw had a furry thumblike extension which was cupped against the main part of the paw. The claws of this thumb, and of the rest of the paw were slid out. Pinned by the claws was a fuzzy gray object about the size of the first joint of a man's little finger.

A thought that had been half-formed in Matt's mind suddenly became clear to him.

"Hang on!" he yelled.

He lifted the ship fast and smoothly.

There was a warning buzz from outside that rose to a threatening drone.

Matt shifted the converter angle, and the ship slid forward.

The heavy drone rose to a piercing whine.

Matt, tensely calculating distances, heard his own voice say, "Did you plug the hole?"

"Yes," said Rrriffuntarr.

Andanelli said, in a low tired voice, "There'll be others. If they can eat through rock, *this* hull won't stop them."

Matt slowed the forward motion of the ship, and shifted the converter angle. The ship slid sidewise.

z'z'z'Z'Z'Z'Z

There was a purple blur. *Whack!* Rrriffuntarr, hit the wall, and dropped to the floor holding up one forepaw. Andanelli picked up his bottle with bug inside, unscrewed the lid, and held it out.

Matt lowered the ship till he felt the resistance of the water.

Rrriffuntarr turned as a buzz approached from the rear of the ship.

Whack!

Z'Z'Z'Z

Slam!

Rrriffuntarr growled angrily and unscrewed the lid of the bottle.

"Hang on!" said Matt.

From the rear of the ship came a droning buzz.

Matt shifted the angle of all the converters.

The ship began to spin on its axis.

One hour and forty minutes later, Sttongg, Klongk, and Battokk crawled dripping wet into the waterlogged air lock and tore out the soggy ruins of what looked like an enormous partly-finished wasp's nest.

Matt, Andanelli, Rrriffuntarr, and Decker, satisfied that they had plugged all the corroded holes in the ship's hull, helped the shivering Kraath back inside, then put Rrriffuntarr's suit together. All four went outside in the thick fog, and cleaned the dripping remnants of a big nest off the UCF housing.

Rrriffuntarr slipped on a soggy lump of the nest, and slid down the curve of the ship into the water. Matt had three holes eaten in his suit by diehard defenders of the nest. Andanelli tripped over a long ropelike thing that trailed upward into the murk from the audio receptor housing. And Decker found so many interesting things to peer at in the fuzzy light of the handbeam that he was no use whatever to the other three.

By the time they all finally groped their way out of the fog back into the ship, and got ready to get back to work, Matt had almost forgotten what they were on the planet for.

Andanelli seemed to be in the same condition. "Let's see," he said groggily. "We have to scrape out a level spot, set up the receiver, and . . . let's see— Is that it?"

"*And* set up the communicator relay," said Matt. "It will take the signals from the satellite, and pass them down to the receiver. We can also send messages through it." He shook his head dazedly. "Assuming we don't wear ourselves out fighting fog, bugs, and other things you can't get a grip on. Since we hit this planet, nothing has worked out right."

"I could have told you that would happen," said Andanelli. "I always know that no expedition is going to work out right, regardless what it is, and I'm right better than half the time."

"Yes," said Matt, struggling to keep his eyes open, "but now what strikes me is that we can't work on that spiral grass, even if we chop it off. Too greasy. The J-bug will slide sidewise. The *pratha* can do it . . . I mean the Kraath, if they don't go into *pratha*. So we'll have to—"

Matt snapped himself upright, and saw Andanelli with his left eye shut and his right eye shutting.

Somewhere in the ship, there was a grating sound, like rats gnawing in the woodwork.

Somewhere, too, there was a faint hiss, as of gas escaping from an unlit burner in a laboratory.

Matt got up and swung his arms back and forth. He did not wake up, but felt even more heavy-limbed and sleepy.

He barely managed to keep his eyes open while he set the autopilot altitude control for five hundred feet.

He shut his eyes, thinking he had had a hard day, but he couldn't be *this* tired.

Something— He had to—

For an instant, everything went gray, as if a lead sheet had slid over his brain.

Matt sat upright, shivering, in a silence broken only by the hum of the converters, and a distant grinding and hissing.

Something grated sharply.

There was a rushing splash, and the ship began to settle.

Matt stared at the instruments.

The ship, he realized vaguely, should be rising. He blinked at the altitude reading.

The ship was slowly settling.

He seemed to realize what had to be done, but did not exactly understand what it was. His mind felt as if it were made up of separate parts, each working of its own volition.

Slowly, like the arm of an automaton reaching out to perform its preset

task, Matt's arm swung out, his hand struck the edge of the autopilot, drew back, and pressed upward against a switch. The switch resisted, then gave.

There was a click.

The converters whined.

There was a scream like a length of rusty wire drawn through a hole in a sheet of iron.

Matt's eyes shut.

He seemed to be inside a maze of gray rooms filled with drifting fog. Somewhere in one of these rooms, he had lost something, but he couldn't remember where. Now the water was rising, and the fog was growing thick. Someone was hammering on a bulkhead, and he recognized the general's voice, saying, "Hurry, Matt! Hurry! We haven't as much time as I thought. *Hurry!*" And Matt was trying to hurry as he sloshed from one room to another in the thickening fog, but he couldn't seem to . . . couldn't seem to—

Somewhere in the distance, an echoing voice was saying, "Once you get there, it will all be comparatively simple."

This voice faded in the boom of a more distant voice, and Matt seemed to lose his thoughts in the boom of this voice, and then he was not worried, about the general or anything else.

Matt woke up with a violent headache. The General Action alarm was clanging in his ears. Automatically he reached for his headset, and snapped on the screen.

The screen was blank.

Decker staggered past, his brow furrowed and his teeth clenched, and hauled himself up into the forward turret.

Matt swung the UCF out of its well.

On the screen, a blotchy view of the nose of the ship swung past. A seemingly endless wall of rock stretched out in front.

"Nose turret ready," said Decker. "Only, all I can see is fog."

Matt swung the UCF as the others reported in.

Below and well to one side, a huge black ship hung vertically, a pillar of pale flame raging from its tail section.

Matt jumped for the controls, then stopped.

Andanelli appeared at his elbow.

"Turret's useless," he said. "I can't even get the cover open."

Matt said sharply, "Decker, do you have anytihng new on the enemy's detectors?"

"Just the usual, sir. Extremely good in space, terrible in atmosphere. They can make out outlines against the sky, and vaguely distinguish land from water. But that's about all."

Matt squinted at the screen. The enemy ship was moving slowly sidewise across a low strip of land at the base of a bluff. It came almost to the end, swung slightly inland, and came back. When it came near the end there, it swung farther inland and went back the other way.

A big air lock in the side of the ship swung open.

Matt reached for the controls.

A slim black cylinder shot out, and spun down around the ship in a fast spiral.

The air lock slammed shut.

The black cylinder swung back up, then down, then up. Gouts of pale flame washed over the huge ship from the flying cylinder.

The ship moved slightly inland and started back in the other direction, rockets blazing.

Matt and Andanelli stared at the screen.

"What in *space*—" said Andanelli.

The monster ship moved inland slightly and again started back on its course.

"Andy," said Matt, "what if *we* had this miserable planet in our back yard? Suppose we sent an expedition here, and it got fouled up in bugs, heaving grass, fog, and heaven knows what else—what do you suppose *we* would do?"

"Send another expedition ten times as big."

"Sure, but how would we get rid of the grass, and how would we keep the ship from getting nested over and corroded through by the bugs?"

Andanelli stared at the screen, then nodded slowly. "Now I get it. They're burning the grass, and scorching the nests as fast as the bugs start to build them— But listen, are they over the place where we want to put the receiver?"

"No, but they're just across the water from it."

Andanelli stared at the huge black ship. "Well, this caps it. How can we do anything with *them* breathing down our necks?"

"Maybe," said Matt, "if we're *very* careful—"

The black ship opened a port. Three slim dark shapes followed each other out and splashed into the water. In a moment, there was a boiling of the water, a dull clap, and a ringing noise in Matt's ears. The *Drake* scraped against the bluff.

Andanelli sucked in his breath.

A thing like a huge set of jaws, surrounded by slowly twisting fronds, came to the surface at one end of the strait. Slowly, sliding in toward the shore below, it sank out of sight.

"I don't mean to be a pessimist," said Andanelli, "but it seems to me we ought to set that receiver up somewhere else.

"How?" said Matt. "The communications satellite orbits so it hangs right over this spot. We're supposed to set up the relay on this bluff, and nowhere else. The receiver has to be down below, and in line of sight from the extension on the relay. It all sounds arbitrary, but we have to assume there's a good reason for it."

"Sir, how do we even know that satellite is still up there? What if our friends here detected it on the way down?"

"It was designed *not* to be detected," said Matt. He frowned, and reached for the controls. "But we'll have to find out. We'll set up the relay. If it works, we'll know the satellite is still there."

Very gently, he began to lift the ship.

Getting the relay—a bulky object camouflaged to look like a boulder—out the air lock and up onto the cliff, and without lifting the ship so far it might show against the sky on the enemy's screens, proved to be a tricky job. The ship had no equipment that could do the job without a lengthy delay. But the Kraath accomplished it by brute muscle power and total concentration on each step from the ship's hull, up the precarious edge of the bluff to its bare, sunlit top.

As Matt snaked the flat extension cable from the communicator to the edge of the cliff, he was glaringly conscious of the early morning sun on his back, and the scout ship hanging in full view just over the edge of the bluff. Down below, the fog lay like a sea, with another bluff rising up like an island a mile or so away. The fog between the two bluffs was almost black, its surface slowly undulating. In the distance, the fog was a lighter gray, and seemed calm, with stray wisps rising from it here and there.

Matt took in this scenery at a glance. Decker started to get absorbed in it, and Matt immediately sent him to watch the screen. Andanelli hardly saw the scene at all. Rrriffuntarr looked warily around and dismissed it with a growl. The straining Kraath plainly had thought for nothing but their burden, and the ground they carried it over.

This ground was thin reddish dirt, with a few sparse plants, and low ridges of red rock showing through. The communicator relay was camouflaged as a dull-gray boulder, that might have fitted in almost anywhere without being noticed. But against the reddish background it stood out like a snowbank in the midst of the desert.

Matt and Andanelli were trying to find some place to sink the boulder into the ground. But the soil was thin, and underlain with rock.

They had no idea how soon the black ship might finish its work and come up out of the fog.

Unable to find any place where the relay was not glaringly obvious, they next tried to hide it by putting the reddish dirt on it in layers. The dirt immediately fell off.

"There's nothing like details," growled Andanelli, rubbing a fistful of dirt back and forth over the smooth gray surface. "In headquarters, they don't think of things like this."

"They have their own troubles," said Matt abstractedly. It was now very plain to him that the rock should have had a rough surface. But it did *not* have a rough surface, and no amount of groaning would fix it.

Andanelli stopped rubbing a moment, and said dubiously, "What about paint?"

Matt frowned in thought, then glanced around. "Rrriffuntarr, go get a blanket and some water."

Rrriffuntarr streaked for the ship.

"If we use paint," said Matt, "we have the problem of getting the right shade and texture. This dirt is exactly right already."

Rrriffuntarr came back with a

blanket and water. Matt and Andanelli found a shallow depression in the rock, worked the dirt there into mud, put the blanket in the mud, and walked back and forth on it till the blanket was soaked and plastered with mud. They put the blanket over the imitation boulder, lifted the boulder to put the edges under it, almost squashed their fingers in the process, stepped back to look at the boulder, and found that it looked exactly like a big fake rock wrapped up in a blanket soaked in mud.

Andanelli swore.

Matt studied the rock critically, shook his head, and checked the extension cable to the edge of the bluff. This, at least, they were able to hide.

Then they went back and did what they could to smudge out the worst of their tracks. The reddish dirt, however, seemed ideally designed to take impressions. The Kraath had left footprints that looked, in the slanting rays of the sun, like the tracks of a herd of elephants on their way through a mudhole.

Everyone was quiet and subdued as they got back into the ship.

Matt dropped the ship down into the thick fog, sent everyone but Andanelli to the turrets, and then looked at the screen.

Down below, the monster ship still traveled methodically back and forth, blasting the vegetation. The cylinder, belching flame, spiraled about the big ship. The water of the strait had a boiling look. The huge pair of jaws with surrounding fronds was again visible, now lying out of water on the shelf where Matt was supposed to set up the receiver.

The two men stared at this scene. Matt said, "Something tells me we'd better use the communicator and let them know back home."

He reached out to a small gray box bolted on the edge of the control panel.

Almost immediately, the communicator began to clack.

Matt and Andanelli got up and watched the following message unreel from the communicator:

HELLO DRAKE STP COME IN PLS DRAKE STP DRAKE HELLO HELLO URGENT DRAKE HELLO DRAKE COME IN PLEASE

"It looks," said Andanelli, "as if they might be just as bad off as we are."

With a sensation of foreboding, Matt pressed down the "Transmit" bar, and sent:

TSF DRAKE SENDING STP WE READ YOU STP COME IN PLS

There was a short pause, then:

HELLO DRAKE WHERE ARE YOU NOW

Matt sent:

AT DESTINATION STP WHY ARE YOU CALLING

BECAUSE VITALLY IMPORTANT YOU SET UP RCVR WITH ALL POSSIBLE SPEED STP HAVE INFO ENEMY HAS DEVICE SIMILAR TO OURS STP THIS DEVICE EVIDENTLY MORE RIGID WITH FIXED RANGE AND LIMITED ANGLE ADJUST-

MENT STP BUT INTELLIGENCE EVALUATIONS INDICATE PLANET WHERE WE PLAN TO SET UP RCVR IS INTENDED FOR USE AS ENEMY FINAL TERMINUS STP YOU MUST SET OURS UP BEFORE THEY SET UP THEIRS STP DO YOU HAVE RCVR SET UP STP WE ARE READY TO COME THROUGH

Matt read this dully, and sent:

WE DO NOT HAVE RECEIVER SET UP YET

SET IT UP IMMEDIATELY

THERE ARE OBSTACLES

OBSTACLES DO NOT MATTER STP TIME IS VITAL STP EXISTENCE OF HUMAN RACE RESTS ON YOUR INSTANT READINESS TO OBEY ORDERS STP AND OBEY THEM REGARDLESS FATIGUE DANGER OR DIFFICULTIES STP IS THIS UNDERSTOOD STP REPLY IMMEDIATELY

Andanelli groaned. Matt swallowed hard and sent:

I WILL DO MY BEST TO OBEY ORDERS WITHOUT HESITATION REGARDLESS FATIGUE OR DANGER SO LONG AS I HAVE STRENGTH TO DO SO

There was a short pause, then the printer clacked:

YOUR ATTITUDE HIGHLY COMMENDED STP BUT TIME IS ABSOLUTELY VITAL STP WHAT ARE DIFFICULTIES YOU SPEAK OF

ENEMY IS ALREADY HERE AND IN CLOSE RANGE STP OUR POSITION AND DENSE FOG CONCEAL US BUT UCF ENABLES US TO SEE ENEMY STP LOCAL LIFE FORMS ON SHELF WHERE WE ARE TO SET UP RCVR APPEAR SUSCEPTIBLE ONLY TO MOST VIOLENT MEASURES STP VIOLENT MEASURES CANNOT BE USED WITHOUT ALERTING ENEMY JUST ACROSS NARROW STRIP OF WATER STP CAN WE SET UP RCVR ON TOP OF BLUFF

There was a long pause, then:

GRAVITIC CIRCUIT CONSIDERATIONS ARE INVOLVED IN LOCATION OF RCVR STP RCVR MUST BE LOCATED FAR BELOW RPT FAR BELOW RELAY STP THIS COULD HAVE BEEN SET UP DIFFERENTLY IF WE HAD KNOWN BUT CANNOT BE CHANGED NOW

Matt frowned, and sent:

CAN COUNTERCURRENT CONVERTERS OF SHIP BE USED TO SIMULATE GRAVITATIONAL FIELD REQUIRED

NO BECAUSE CURVATURE OF COUNTERCURRENT FIELD IS TOO GREAT AND WOULD CREATE DISTORTION

CAN WE GO ELSEWHERE

YES BUT ONLY IF YOU MOVE SATELLITE AND FIND HEIGHT RELATIONSHIP SIMILAR TO PLACE WHERE YOU ARE NOW STP YOU MUST NOTIFY US AND WE WILL TEST TRANSMISSION TILL SATISFACTORY

"That," said Andanelli, "might be the only way to do it. We'll have to creep around the cliff, get out of detector range—"

Matt tapped out:

HIGHLY DANGEROUS TO ATTEMPT TO REACH SATELLITE OWING TO HOLING PITTING AND CORROSIVE WEAKENING OF HULL BY LOCAL FORMS OF LIFE

"I forgot that," said Andanelli.

"We'd have remembered it," said Matt, "once the air started whistling out."

The communicator clacked:

INFORMATION HERE INDICATES NO SUCH FORMS OF LIFE ON PLANET AS YOU IMPLY STP STATE IMMEDIATELY AND BRIEFLY ALLOWING ONE SENTENCE EACH DESCRIBE THE APPEARANCE AND CHARACTERISTICS OF THESE LIFE FORMS

Andanelli swore:

Matt drew in a deep breath, glanced at a corner of the room for an instant, then tapped out:

THERE ARE THREE LIFE FORMS WHICH LIVE AT THE BASE OF THE BLUFF OR IN THE STRAIT NEARBY STP ONE IS AN EYELESS NESTING INSECT LIVING AT THE BASE OF THE BLUFF AND CAPABLE OF SECRETING A HIGHLY CORROSIVE LIQUID STP

Matt was about to add that this insect had built its huge nest in the air lock, but realized that he was supposed to give his description in one sentence. Scowling, he went on:

SECOND IS A GREASY SPIRAL INTERLOCKING GRASS WHICH MOVES IN WAVELIKE MOTION AND SEEKS TO THRUST OBJECTS INTO THE WATER AND SUCCEEDED IN DOING SO TO NO LESS THAN SIX MEMBERS OF THIS SHIP'S COMPLEMENT INCLUDING THREE WHO WERE ATTEMPTING TO REMOVE A LARGE NEST OF INSECTS FROM THE AIR LOCK STP

Now that Matt had tapped this out it was sent and he could not unsend it. Looking at it, Matt was struck by its wordiness and seemingly defensive tone. But he was required to condense all the facts into one sentence and do it without delay. He went on:

THIRD IS A FORM OF LIFE SEEN ONLY ON UCF AND WHICH APPEARS TO CONSIST OF AN ENORMOUS SET OF JAWS SURROUNDED BY A FRINGE OF TENTACLES

Matt hesitated, looked at this uncertainly. The communicator shoved his message up and printed:

WHO IS SENDING

Matt tapped out his name, rank, and serial number.

With no hesitation whatever, the communicator printed:

COLONEL STEPHEN MATT IS HEREBY REMOVED AS COMMANDING OFFICER TSF DRAKE AND PLACED UNDER ARREST STP MAJOR JAMES J ANDA-

NELLI IS HEREBY PLACED IN COMMAND TSF DRAKE WITH FULL AUTHORITY TO TAKE WHATEVER ACTION OF ANY KIND IS NECESSARY TO SET UP RECEIVER AS SOON AS POSSIBLE

Andanelli, his face dead white and his eyes glittering, hit the "Transmit" bar, knocked the preceding message up two spaces, and rapped out:
ANDANELLI SENDING STP DO YOU READ ME

WE READ YOU STP COME IN ANDANELLI

With a look of intense concentration, Andanelli slowly tapped out:
SCOUT SHIP TSF DRAKE NOW WITHIN CLOSE RANGE ENEMY CLASS III CRUISER STP NO ENEMY CLASS III CRUISER EVER KNOWN TO BE SERIOUSLY DAMAGED BY LIGHT ARMAMENT OF SCOUT SHIP STP SITUATION HERE COMPLEX BEYOND ANYTHING CAPABLE OF BEING BRIEFLY REPORTED TO YOU STP EVERYTHING SO FAR REPORTED TRUE BUT GROSSLY UNDERSTATED BECAUSE OF NEED FOR BREVITY STP MY OPINION IS ONLY A MIND CAPABLE OF APPROACHING THIS PROBLEM INDIRECTLY BUT WITH FULL APPRECIATION ALL FACTORS HAS ANY CHANCE OF SUCCESS STP PREVIOUS EXPERIENCE SHOWS ME PLAINLY THAT YOUR ORIGINAL CHOICE OF COMMANDER WAS AND IS STILL ABSOLUTELY CORRECT STP I THEREFORE USE FULL AUTHORITY DELEGATED ME TO TAKE NECESSARY ACTION OF REPLACING IN COMMAND COLONEL STEPHEN MATT STP THIS ACTION EFFECTIVE IMMEDIATELY STP IF THIS ACTION COUNTERMANDED BY HIGHER AUTHORITY I WILL WITHOUT HESITATION IMMEDIATELY ATTACK ENEMY CRUISER

Andanelli knocked the message up two spaces, and waited, his eyes narrowed.

Matt, standing perfectly still, nevertheless had the sensation that the room was slowly turning around him.

The communicator sat unmoving as if, far away at the other end of the chain of command, nobody dared touch his finger to a key for fear of upsetting the delicate balance.

After a long delay, the communicator slowly and gingerly clacked out a message:
YOUR ACTION APPROVED STP COLONEL STEPHEN MATT REINSTATED RPT REINSTATED STP INADVISABLE ATTACK ENEMY CRUISER STP ADVISE GREATEST CAUTION STP REPLY AT ONCE

Andanelli stepped back from the communicator with a look of grim satisfaction. He glanced at Matt, grinned, and bowed, "After you, sir."

The first glimmering of an idea had just come to Matt. He wanted to think, not pass messages back and forth.

The communicator clacked:
COME IN PLEASE

Matt stepped forward, still thinking.

The communicator printed:
HELLO DRAKE COME IN PLEASE

Matt stopped in front of the communicator, his chin in his hand and his eyes half shut. He almost had it, and when it became clear, he didn't want to lose it.

DRAKE HELLO HELLO PLEASE COME IN DRAKE

Andanelli said savagely, "*Good.* Let *them* worry for a while."

Matt could see the idea now in all its connections. Whether it would work, he didn't know. But he had it.

DRAKE DRAKE ARE YOU THERE DRAKE DO YOU READ US PLEASE COME IN

Matt hit the "Transmit" bar:
MATT SENDING

There was another pause as the people on the other end considered that they were now talking with the man they had just dismissed, who had been reinstated against their will, and who, it now appeared, very possibly had right on his side. For some time, nothing came from the communicator, then:

DO WHAT YOU THINK BEST MATT STP WE WILL GIVE YOU ALL HELP AND INFORMATION WE CAN

Matt thought a moment, then sent:
IS CASING OF RECEIVER VITAL TO ITS OPERATION

NO STP ITS ONLY FUNCTION IS TO PROTECT INTERNAL MECHANISM

MUST IT NECESSARILY BE PLACED ABSOLUTELY LEVEL

YES THIS AMOUNTS TO ITS BEING CORRECTLY POSITIONED GRAVITICALLY STP IF NOT LEVEL IT CANNOT FUNCTION

COULD IT BE BRACED UPON OR SUSPENDED FROM THE DRAKE RATHER THAN SET UP ON THE GROUND

NO BECAUSE INDUCED CURRENTS IN CONVERTER OF DRAKE WOULD CAUSE GRAVITIC FIELD DISTORTION

WOULD PRESENCE OF ORGANIC MATTER WITHIN OPEN FRAME OF RCVR CAUSE TROUBLE

NOT IF IT CAN BE BROKEN LOOSE WITHOUT DAMAGING RCVR STP ACTION OF RCVR WOULD THRUST EVERYTHING WITHIN OUT AS SOON AS IT BEGAN TO OPERATE

CAN YOU SEND SOMETHING THROUGH BIG ENOUGH TO FINISH OFF ENEMY CRUISER WITHOUT DELAY STP CAN THIS HAVE SPARE RCVR RPT SPARE RCVR ON BOARD IN CASE FIRST RCVR DAMAGED BY ENEMY ACTION

There was a short delay, then:
YES WE CAN DO THIS

Matt tapped out:
THANK YOU STP THAT IS ALL FOR NOW

OK DRAKE WE WILL BE RIGHT HERE IF YOU WANT US STP TELL US WHEN WE CAN COME THROUGH

The fog had faded into blackness and lighted to dark gray again before Matt and Andanelli were satisfied that they had everything ready. By this time, the huge set of jaws had slid back into the water, and the enemy cruiser had finished its trips over the strip of land across the strait, had swung horizontally and blasted the cliffs there, had landed and disgorged an immense quantity of mechanical equipment which speedily and methodically leveled off the strip of land and started to climb back into the ship.

"Nothing like plenty of power," said Andanelli enviously.

"Look," said Matt.

Several small shadowy forms were coming out of the black ship, carrying long thick pipes, and sizable globes.

"O.K.," said Matt. "Here we go."

He dropped the ship slowly down the side of the bluff.

On the screen the shadowy figures

methodically began to assemble their device.

A buzzing sounded from the audio receptor phones. The buzzing rose to a drone.

Matt swung the UCF into its well.

Watching his instruments, he slowly swung the nose of the ship ninety degrees out from the bluff. He hung there a moment, then slid the ship forward.

The buzzing was continuous, a droning so loud as to seem almost like thunder.

"We must have been right in their nests," said Andanelli, awed.

Matt lowered the ship gently, holding his mind away from the thought of the huge black ship towering just across the narrow water.

Beneath the steady buzz, the converters gave their high-pitched whine.

Matt rotated the ship one-quarter turn right.

Carefully, he lowered the ship.

The buzz stayed right with them, and rose to a threatening drone.

The ship settled, then came to a stop.

In the earphones, Decker said, "Water popped the plugs out of the lower two holes."

Matt increased the converter current.

"And the next two. This plate looks as if it might buckle."

The droning rose to a whine.

Carefully, Matt slid the ship forward. Ahead of him, he seemed to see the black ship, towering ever higher. Below him, he could almost feel the thing they had seen on the

screen, lying under the surface, and nursing its bruises. As the *Drake* moved slowly across the strait Matt realized that his mind was split, part of it on calculations and movements that he performed almost mechanically, and part of it in intense and silent prayer.

Decker said, "They're eating through already. I've patched that one. But I see a place I can't get to."

"Do your best," said Matt. He swung the UCF, now half underwater, out of its well.

The half of the screen clear of the water showed him he was almost ashore, and closer to the towering black ship than he had intended. In front of him rose a tall unfinished frame, with shadowy figures standing dead still around it. Then the screen filled rapidly with gray blotches.

"Now," said Matt.

He swung the ship smoothly up and forward, the UCF swinging clear of the water, the ship turning on its axis. He lowered the ship. "Let go the coverings."

"Yes, sir."

The ship slid forward. There was a grating noise.

From the black ship, three long slim shapes shot out into the water.

The shadowy figures were running from the half-finished frame, beating their arms frantically about their heads.

The *Drake* was now level.

"Let go the receiver."

"Yes, sir. It's down."

From the direction of the water, there was a heavy dull thud.

Matt swung the UCF around. He saw the receiver's big cubical frame standing on the level ground by the *Drake*. He glanced at his control board. A light was flashing on and off, on and off, then it blinked out entirely. The receiver was level.

"Thank God," he breathed, and threw the ship low and fast across the flat layer of concrete toward the far wall of the bluff. He reversed the converters, stopped the ship, jumped up and jabbed the communicator.

COME THROUGH WE ARE READY COME THROUGH

There was a glare like the sun reflected blindingly from still water.

The black ship stood on a pillar of flame.

A gigantic rim hung in the air beside it.

The screen lit in a blaze of white; the figures blurred in distortion and were gone. A spot on the inner wall of the *Drake* glowed dull red.

There was a ringing clap that seemed to explode inside of Matt's head.

The screen oscillated wildly, then cleared.

The black ship was a shell wilting like a hollow candle before the open door of a furnace.

The huge rim hung unmoved.

Matt swung the UCF to see what had happened to the receiver. But the receiver was gone.

The communicator clacked:

ARE YOU O.K. DRAKE

Matt rapped out:

FINE STP BUT WHERE IS RCVR

VAPORIZED STP WE HAVE

SPARE ON BOARD STP IS ATMOSPHERE O.K.

ATMOSPHERE MAY BE BUT THICK FOG CUTS VISIBILITY STP FLYING BUGS NAVIGATE THIS FOG WITHOUT DIFFICULTY STP THESE BUGS SQUIRT CORROSIVE LIQUID THAT EATS THROUGH SUITS AND HULL OF SHIP STP THEY BUILD HUGE NESTS IN SHIP'S AIR LOCK AND ON PROJECTIONS OF SHIP STP ALSO IN UCF GRID THUS DISRUPTING RECEPTION

After a moment, the answer came:

NOT CONCERNED FOG OR LOCAL LIFE FORMS STP STAND AWAY BELOW STP MUST DROP OVERHEATED DRIVE UNIT

Matt swung the *Drake* up and farther inland. On the screen, which Matt realized with a start now functioned perfectly, there fell from the huge Terran ship a glowing cylinder with a length of pipe thrust off-center out of one end. This glowing cylinder hit the water, sent up a splash, and sank out of sight.

Matt turned away as a buzz came toward him from the rear of the ship.

The communicator clacked twice and stopped short.

Matt glanced toward the communicator, then a swift movement caught his eye. He whirled back to the screen.

On the screen, a huge set of jaws rose straight up out of the water and clamped on the giant rim.

Matt sprang to the communicator to see if an order had been sent him. Printed there were two letters:

WH

z'z'z'Z'Z'Z'Z'z'z

"*Sir,*" cried Decker, "spin the ship one-eighty degrees so I can get at this hole. They're coming in by the dozens!"

Matt jumped to the controls.

The next hour passed in chaos. Matt spun the ship. Decker plugged the holes. Rrriffuntarr snatched the buzzing insects out of the air. The three Kraath splattered the bugs against the walls of the ship. One of the Kraath hit so hard he knocked out a fist-sized section of corroded wall, and the bugs came through in hundreds. Matt sent the ship streaking for the open sea; and dove. Something gently caught the ship and there was a munching crunching sound. Matt slammed the ship skyward then dropped it fast. On the viewscreen there hung a big black ship like the one that had just been destroyed. Matt dove for the communicator and found there about a dozen bugs that had set up housekeeping in a small nest they were ready to defend to the death. Matt hit the keys and sent:

LOOK OUT ENEMY SHIP APPRO

z'z'z'z'Z'Z'Z

z'z'Z'Z

z'z'Z'Z'Z'Z'Z

Z'Z'Z'Z'Z

His whole body seemed to dissolve in an agony of fire.

Matt came to in the flagship's hospital ward and didn't get out for

three weeks. Once out, he was ordered to the Commanding General's office, and found himself saluting the general who had given him his orders at the start.

The general had one leg thrust out stiffly on a hassock, his left arm in a sling, and a bandaged forehead. He looked at Matt, and growled, "The next time you send me a report, I will believe it."

"I should have put it more clearly, sir. But we were a little shaken up."

"Having been out in that fog," said the general, "and burned by the bugs, and rattled around like dice in a cup when we dropped that drive unit, I can guess what it was like. Since then, I've had two weather stations blown off the top of that bluff by freak winds, a whole ship's crew anaesthetized and almost eaten alive by something that gnaws through the hull of a ship and pumps in gas, and thousands of man-hours lost thanks to that unending fog. What a place! You can't tell where water, air, or land end. It's not a beachhead; it's a foghead."

"Sir, has anyone found out why there's so much fog?"

"They've made noises about it," said the general. "These islands sit practically at the boundary of a warm ocean current flowing north, and a cold current flowing south. I've also been told, part of the trouble comes from the springy plants, that reproduce by thrusting up tall stalks with puffy growths on top; these puffs burst and let out clouds of tiny seed when they're disturbed. The more they're disturbed, the more stalks they grow, the more puffs burst, and the more drifting clouds of fine seed come out. They've been disturbed a lot lately.

"In fact, three of our ships are hung up because some boob got the idea it would ease matters for the air purifiers if they used planetary air instead of recycling. They've got plants sprouting out of the filters, and taking root in any dark spot where there's a stray speck of dust. *Your* ship practically had to be gone over with a blowtorch to sterilize it. And that reminds me." He leaned forward to snap on the intercom.

"How's that final check coming on Colonel Matt's ship?"

"About done, sir."

"Good. Let me know when you're through."

The general leaned back. "Despite the exasperation of this place, things have worked out about as we hoped. But it was close. How did you manage to set up that receiver right under the enemy's nose?"

"Well," said Matt, "they generally rely on a visual system in atmosphere. That was useless here, and their screens are specialized for space. Still, their audio receptors might have picked up our countercurrents. We eased down the bluff, and hung there while the bugs started to nest. We tilted the ship, so the hatch, where the receiver was held on, was out of water. The UCF was half under, so we could see with that part when we swung up to come out.

"The bugs, meanwhile, buzzed and

droned, and masked the countercurrents. By the time we got across they were wet and mad, and went for the technicians. We tilted the ship to swing the receiver into position, and let go a cover we had over the base frame to keep the bugs from nesting and throwing the receiver off level. We moved ahead and let down the receiver. We had to use the air lock remote arms to do it, and that meant we had to let the bugs *start* to get settled, but we had to get across before they either corroded through the ship, or blocked the arms. Once we had the receiver set up, we got out of there, and you came through."

The general leaned back and nodded. "And just as we thought we had everything taken care of, we almost got shaken to pieces. That's a peculiar thing about war or exploration. In either one, you have to operate in a fog of uncertainties. When you get involved in both together—"

A buzzer sounded, and the general snapped on the intercom. A voice said, "Sir, Colonel Matt's ship is ready."

"Fine." The general beamed at Matt, and said, "Colonel, I am going to forestall any attempt on your part to volunteer for further service . . ."

Matt, who hadn't even thought of volunteering, tried to look disappointed.

". . . By sending," the general continued, "you and your crew back to Base immediately. This exploit has entirely changed the balance of the war. You and your men have been cited for extraordinary heroism, have been recommended for immediate promotion, and can expect to be cheered, lionized, goggled at, and sent around on so many speaking tours you'll wish you'd never joined the service. Personally, I want to thank you for getting that receiver up, and I wish you a good trip home, and the best of luck."

"Thank you, sir. I wish you the best of luck."

They exchanged salutes.

Matt went back to the ship and found Andanelli peering through a bandaged left eye into the plot viewer. "Some course we got," he said. "The place is lousy with enemy raiders. We've got to practically hop from frying pan to frying pan till we get back to Station VI. Do you realize they've only got a one-way line between here and VI? They're running the war on a shoestring."

"Just so long as they win it," said Matt. "By the way, we were in the hospital a long time. Did the Kraath—"

Andanelli nodded cheerfully. "They're over their *pratha*. We don't have that to worry about."

The trip back was fast and hair-raising at the breaks in and out of subspace. Between breaks, the first part of the trip was so restful that Andanelli shed his cynicism long enough to remark, "This is the life. At this rate we'll be home in no time."

Matt was leaning back in the control seat, contemplating the back pay piled up for him at Base.

"We could," said Matt, "still get smeared at a break point, but it's a relief to be able to get a little rest between times."

Decker came in carrying a small black book, and wearing a puzzled expression.

"Sir," he said, "here's a funny thing. In here, it says Lithians never have more than two cubs at a time. But—"

Matt's feet hit the deck with a slam.

Andanelli froze.

Into the control room padded three purple balls of fluff and claws, their tails waving.

One carried a shoe, which it wrenched and shook, as if to break its back.

One carried a sock, shredded almost beyond recognition.

One carried nothing, and looked all around with hungry glittering eyes.

From the corridor came the rumbling purr of a big Lithian, claws clacking on the steel deck as it indulgently followed the cubs.

From the far end of the ship came the roar of an indignant Kraath:

"Who stole my shoe?"

It was a long trip home.

THE END

PROBLEM IN ABSTRACT JUSTICE

A small boy is found playing the old game of lighting matches to see them burn. His activity is stopped . . . but now comes the question of punishment.

He did not start a destructive fire. He did not expect or intend to start a destructive fire. Therefore to punish him would be punishment for something he *had not done, and did not intend to do.* Would that be just?

If he has previously been told that playing with matches is absolutely forbidden, on pain of severe punishment, then the punishment is applied to enforce an authoritarian, dictatorial ruling—a "Because I say so!" dogmatism. Is punishment on that basis ethical and just?

If no authoritarian command to leave matches alone had been given, and punishment is based on "You should have known better!" is that not an authoritarian ruling on the nature of what "should" have happened, or existed, without reference to reality?

If no punishment is administered, and the child concluded from his real experience—playing with matches did not cause any destruction—that the act is safe and entertaining, it is probable that he would repeat the action despite argument that it was theoretically unsafe. (No evidence of that unsafeness in his experience!) Would it be ethical or just to leave the child with that inappropriate evaluation?

A sound spanking would, of course, relieve parental tensions . . . but can you define the ethical justice of either doing so, or not doing so?

THE QUARRY

BY GORDON R. DICKSON

Illustrated by Martinez

Of course children always want their broken toys fixed— but the toy might not want to be...

E WENT in under here," said the older of the two boys. "I saw him."

"He couldn't get under a rock like that, Jix," the other said. "He's too big."

"But he's awful skinny," said Jix. "Raby, you go around the other side and I'll call him. If he comes out your way, you hold him until I get there." Raby went off, and Jix bent down the opening. "Mr. Johnson!" he called. "Come on out, Mr. Johnson! It's only us."

Under the rock William Johnson twiched convulsively and squirmed deeper into the mold-smelling earth. He pressed his mouth to it, its grittiness against his teeth, to hide the sound of his breathing. Hollowed and drawn out between earth and rock, Jix's voice reached down to him again.

"Mr. Johnson, you come out now. If you don't come out, I'll have to come in and get you."

William did not move. Then, after a long, breath-held moment, he heard the rattle and scrape of a body crawling toward him under the rock. He made a high, squeaking sound in his throat and suddenly threw himself away from the approaching sound, scrabbling back and up through the loose earth to the far underside of the rock. The light of day broke suddenly in on him, and he saw the far overhanging edge of the rock. Then he was out from under it, into the grass and the sun. He jerked to his feet, ready to run, and then two slim arms caught and held him.

"Jix!" cried the voice of Raby, triumphant. "I got him! I got him here!"

There was the sound from under the rock behind him and a second later Jix came around to stand before Johnson. Dirt had refused to cling to Jix's shimmering shorts and tunic. He stood in front of William, his head about shoulder-high on the man, his face as beautiful as a profile on a cameo, sad and concerned.

"Mr. Johnson," he said, "why do you run off like that? Don't you know how easy it is for you to get hurt? We've told you and *told* you, Mr. Johnson."

William did not answer. He whimpered and struggled ineffectually in Raby's grasp.

"What'll we do, Jix?" asked Raby. "He's all excited, and he's going to hurt himself if he doesn't stop fighting."

"I think he wants to get back under the rock," said Jix. "Let's take him away to where there's nothing for

him to crawl under. Then maybe he'll relax."

He led off. Raby followed, holding William's arms and pushing him along. As they went, William's resistance slowly melted. He ceased to fight against Raby's urging and the tension went out of his arms. After a little while the younger boy let him go and he trudged along with them with his head bowed, his gray hair falling forward over his gaunt, youngish-looking face and his arms in their irridescent sleeves—he was dressed in the same fashion as Jix and Raby—swinging limply on either side.

They had been on the side of a stone-tumbled hill, just below its peak. This peak they went up and over now, and down the far side onto a smooth falling-away of land, so carpeted with fine grass that it seemed almost parklike. In the nearer distance was a great, abrupt hole several acres in area, with a glimpse of vertical sides of white rock. Beyond this were the hazy blue shoulders of the foothills to the mountains, and here and there amongst them a flash or hint of bright color that gave no clue to its shape or purpose in being.

They went on until they reached the smooth lawn-level grass beside the quarry; and there the two boys sat down, pulling William down with them. They sat cross-legged like Indians in a rough circle.

William's eyes, for all that his body was loose again, were still abstract and wild. They stared away at the foothills; and slowly two tears formed in them, welled up and began to streak their way down his hollow cheeks.

"Home—" he said suddenly, brokenly, "home—"

Jix reached over and rhythmically, slowly, soothingly, rubbed William's near shoulder.

"Now, Mr. Johnson," he said, "you know you can't go home. You can only go forward in time, not back. We told you and told you," he almost chanted the words, matching the rhythm of his moving hand, "and *told* you you can't go back."

William put his head down and sobbed.

"Now, Mr. Johnson," said Jix, "it's really no use getting all unhappy. If you'll just look up and around you, you'll see all sorts of things to feel good about. See how the foothills seem to go right up into the air like towers—look, Mr. Johnson." Slowly, as if unwillingly, the man raised his head and turned it toward the foothills. "That darker blue behind them, that haze, that's really the mountains, only the humidity's up and we've got a temperature inversion back a ways. Isn't that something to see, Mr. Johnson?"

William swallowed, looking off in the direction indicated.

"And look at this," broke in Raby, plucking a single blade of grass and holding it up before his face, "look at this, Mr. Johnson. See how fine and sharp the lines are. So beautiful. And all complete and whole in one

little piece. Doesn't that make you happy?"

Suddenly, William knocked the hand holding the blade of grass aside.

"No!" he cried. "No!"

"Please, Mr. Johnson," said Jix, now rubbing his hand soothingly up and down the sharp adult spine. "Try just a little bit to like things. You'll feel a lot better if you do. It's nice here, but you won't let yourself like it."

"It's not!" William snapped his head back and forth, glaring first in one young face and then in the other. "Not like home!"

"But you can't *go* home," said Raby. "And it really wasn't very nice back then, Mr. Johnson, you know that as well as we do, but you won't admit it. It was dirty, and people were sick all the time, now wasn't it?"

"No!" exploded William. "It was fine, and plain and natural—" He sobbed again, suddenly. "There were people you could talk to. Plain people, who liked ordinary things and lived in real houses. They ate real food—real, cooked food."

"You can have anything you want to eat, Mr. Johnson," said Jix. "We'll get it right now for you."

"I don't want your food!" cried William, desperately. "It isn't real! It isn't honest."

"Why, yes it is," said Jix. "Now, you know that, too, Mr. Johnson. It's just as real as the food you used to get by killing animals and cooking up plants. It's just made out of the essential raw materials, that's all."

"I say it's fake!" William jerked about on the grass between them as if he would get up and run, but did not do so. "It's not right." He whimpered, dropping his voice and head. "It's not right," he whispered to the grass between his spread legs. He lifted his head. "All right," he said defiantly. "Make me eat it."

"Mr. Johnson," said Raby, "we couldn't do a thing like that. Could we, Jix?"

"Not unless Mr. Johnson really wants us to," said Jix, firmly. "And we know he doesn't."

William brought his face around slowly to sneer in the face of the older boy.

"Oh, you're sure about that, are you?" he said, softly. "You're so sure." Jix did not pull his face back or alter his expression as the man's hot breath fanned his eyelashes. "You're so sure you know what I really want, and you try so hard to give it to me, don't you? And why? Why?"

"We feel sorry for you, Mr. Johnson," said Jix.

"I'll bet you do. I'll—just—bet—you—do." William pushed himself suddenly forward and onto his knees, so that he kneeled before Jix looming over him. "Do you know what I am?" he said softly. "I'm a physicist, a research physicist. I've got four degrees, do you you know that? *Four college degrees!* I've got a million-dollar appropriation to do whatever I want—and I did something with

it nobody ever did before, something nobody was ever intelligent enough and skillful enough, and trained enough to do before. I traveled into the future, into the far future. That's the kind of man I am."

"We know, Mr. Johnson," said Raby, from behind him. "You told us, you know, lots of times."

"Then what're we sitting here for?" cried William, sitting back on his knees and looking from one to the other. "Where are the men who ought to be talking to me? Where are the scientists? Where are the historians? Where are the institutes?"

"There aren't any, Mr. Johnson," said Jix. "Everybody told you that. Not the way you think. Everybody knows all about those things you know, but they're too busy to bother with them."

"Busy? Busy at what?" cried William.

"We told you and told you, Mr. Johnson," said Raby, patiently, "that it's no use your trying to make us tell you, because there isn't any language for explaining what people do. You've just got to *understand*."

"Try me. Make me understand."

"But you can't," said Raby. "You weren't bred to *understand*. It took generations and generations of gene selection and crossing to evolve people who could *understand*. That's why the grownups don't have anything to talk to you about."

"Then why do you two talk to me?" William clenched his fists. "Why you?"

"But we're just children, Mr. Johnson."

"Children!" William's voice broke on a fresh sob. "Call yourselves children! Oh, no. Children are little and not strong. You show them things. Children believe you. You? Children?"

"But we are," said Jix, calmly.

"No, you're not." William straightened up, staring at them. "Children? You're monsters. Monsters stronger than I am. Monsters who know everything, who can do anything, who haven't a shred of natural feeling. Children? Children laugh. Children cry. You don't laugh or cry, either one of you. You don't hate. You don't love."

"Mr. Johnson!" said Raby. "You know better than that. We love everybody. We love you, too."

"Love? Me? When you torture me like this, day after day? When you follow me around, making a fool of me, always hounding me, showing me up—"

"We'll go away if you want," said Jix. "But every time we go away, you come looking for us."

"Not you! Not you!" William shook his clenched fists above his head. "I want real people, adult people to talk to."

"But nobody has time to talk to you but us," said Jix. "We told you that. Besides, we want to look after you. You're liable to get hurt if we don't watch you. You're always doing something that's going to get you hurt when we leave you alone, then we have to catch you before you do."

He gestured at the wide hole a few yards off. "You nearly fell into the quarry, day before yesterday."

"The quarry!" groaned William. "Oh, God! And why did you make a quarry there in the first place? Did you just want one? Or did you want to play King Arthur with a real stone castle?"

"Our father wanted it," said Raby. "We *told* you that."

"He?" William gave a shout of high-pitched laughter. "The great man? The mysterious head of the household, who doesn't even exist part of the time? You mean he needed real stone? Plain stone?" William's voice rose on waves of hysterical laughing. "Plain, ordinary limestone? What for?"

The two boys looked at each other helplessly.

"It's one of those things I have to *understand,* isn't it?" shouted William, leaping to his feet. "Liars! Fake!" he began to dance before them, stamping his feet and bobbing his shoulders like a savage. "Mumbo jumbo! Witch doctor! Witch doctor! Spirits of the mumbo . . . jumbo . . . mumbo—" Abruptly, he stopped chanting and dancing and stared at them, his face falling into a look of agony. He fell to his knees and stretched out his skinny arms to them. Dragging himself forward on his knees, he approached them.

"Please," he said, "please . . . oh please! You can do anything. I know you can do anything. Put me out of my misery. Make me happy here. Make me not know any different. Make me forget. Fix me . . . fix me—"

The two boys looked at him with sad and solemn eyes.

"Poor Mr. Johnson," said Jix. "We can't do that. If you understood, you'd know it wasn't right for us to do it. If we changed you, it would spoil you, and we would be spoiled by doing such a thing. It isn't right for people to be changed, Mr. Johnson, except by themselves."

"But I'm not people," he clawed at their glittering tunics, "I'm an animal. I'm a pet. Have pity . . . oh, have pity—"

"No, Mr. Johnson," said Jix. "Even you know that. You're not an animal or a pet at all. You're a human man with a soul who has to find his own way, like everybody."

"But I can't . . . you all say I can't!"

"Poor Mr. Johnson," said Raby softly. "If only you'd understand."

"Make me understand," William pleaded.

"Nobody can make you understand, Mr. Johnson."

William screamed suddenly and rose to his feet. Extending his shaking hands to the air, he screamed at the sky. And then, whirling, before even the quick reflexes of the boys could stop him, he turned and ran toward the open edge of the quarry. He ran forward and out. For a fraction of a second he continued forward, seeming to run in empty air, and then he dropped from sight.

The boys leaped and ran to the

edge of the quarry. Before they reached it, the sound of an impact came up from the depths. They stopped at the edge; and, looking over, saw the broken body of William lying on the pale wet rock, far below.

They looked at each other. Then they started to climb down into the quarry.

Their mother was in the garden of their house, that was like no house William had ever known, as they came up a little later carrying the crushed and ruined body. She turned to face them, a tall woman with pale skin and dark hair and as beautiful as they. Her eyes took in what was left of William and her exchange of glances with the boys seemed to gather the whole story.

"He suddenly jumped, Mother," said Raby. He looked up at the tall woman with eyes that were still the eyes of a child. "Is he all spoiled?"

"No, Raby," she answered. "Nothing is ever all spoiled. Give him to me." She took the dead man from Jix's arms easily up into her own. "I'll give him to your father when he gets back. Your father will fix him, and he'll be as good as ever in the morning."

THE END

IN TIMES TO COME

Coming up in the next issue is a Clifford D. Simak story, (I wish he'd quit editing that newspaper and do more writing!) titled "The Big Front Yard." And Kelly Freas has done a cover for it. And I think they're well matched; they're both lovely pieces of work. Cliff's hero isn't exactly heroic, and he has mice . . . or something . . . in the woodwork for a while. And his darned dog goes down a most peculiar woodchuck hole . . . next to be encountered half a dozen star-systems away! *Most* peculiar "mice" in the woodwork, too . . . they repair things like TV sets. (Well, not exactly "repair," because it wasn't a color TV set when it was brought in, so you couldn't say they "repaired" it exactly . . .

Also upcoming: a strict, straight, fact article on the commercial, engineering application of a psionic device in routine operation. I found it unusually provocative, because the man who uses the device has one, and only one reason for using it; over a period of years it has worked to save money. Not his money, incidentally—the City of Flint, Michigan's!

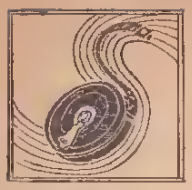
THE EDITOR.

HARVEST TIME

BY JAMES H. SCHMITZ

One of the things that makes Scientists dislike Engineering is that people don't mind what you think, so long as you don't do anything. But politics enters the moment you start accomplishing...

Illustrated by Freas



SENIOR Assistant Commissioner Holati Tate sat comfortably on a high green hill of the Precolonization world of Manon, and watched Communications Chief Trigger Argee co-ordinating the dials of a bio-signal pickup with those of a recorder. Trigger was a slim, tanned, red-haired girl, and watching her was a pleasure from which neither her moody expression nor Holati Tate's advanced years detracted much. She got her settings finally, swung around on her camp chair and faced him. She smiled faintly.

"How's it going?" the S.A.C. inquired.

"It's going. Those bio-patterns aren't easy to unscramble, though. That to be expected?"

He nodded. "They're a mess. That's why I had to borrow a communications expert from Headquarters."

"Well," said Trigger, "if you just want to rebroadcast the strongest individual signal, we'll have a usable transcription in another ten minutes." She shielded her eyes and peered up at the late afternoon sky. "Can't see more than a green tinge from here. The Drift's about nine miles up, isn't it?"

"At nine miles you're barely scratching the bottom layer," Holati Tate told her. "The stuff floats high on this world."

Trigger looked at him and smiled again, more easily now. She liked Holati, a weather-beaten little Precol veteran who'd come in as a replacement on the Manon Project only six months before. Assistant commissioners were mostly Academy graduates nowadays; he was one of the old guard the Academy was not too gradually shoving out of the supervisory field ranks. Trigger had heard he'd been in the Space Scouts until he reached the early retirement age of that arduous service. "What's this beep pattern we're copying supposed to be?" she inquired. "Sort of a plankton love call?"

Holati admitted that was as good a guess as any. "At the Bio Station we figure each of the various species keeps broadcasting its own signal to help the swarms keep together. This signal is pretty strong because the Drift's mainly composed of a single species at the moment. When we set up the food-processing stations, we might be able to use signal patterns like that as a lure."

Trigger smoothed her red hair back and nodded. "Dirty trick!" she observed amiably.

"Can't be sentimental about it, Trigger girl. Processed plankton could turn out to be Manon's biggest export item by the time it's a colony. The Federation's appetite gets bigger every year." He added, "I'm also interested in the possibility it's the signals that attract those Harvester things we'd like to get rid of."

"They been giving you trouble again?" Trigger's duties kept her close to the Headquarters area as a rule, but she had heard the Harvesters were thoroughly dangerous creatures

capable of producing a reasonable facsimile of a lightning bolt when disturbed.

"No," he said. "I won't let the boys fool with them. We'll have to figure a way to handle them before we start collecting the plankton, though. Put in a requisition for heavy guns last month." He studied her thoughtfully. "Something the matter? You don't seem happy today, Trigger."

Trigger's thin brown brows slanted in a scowl. "I'm not! It's that boss we've got, the Honorable Commissioner Ramog."

Holati looked startled. He jerked his head meaningfully at the recorder. Trigger wrinkled her nose.

"Don't worry. My instruments are probably the only thing that isn't bugged around the Manon Project Headquarters. I pull the snoopies out as quick as Ramog can get them stuck in."

"Hm-m-m!" he said dubiously. "What's the commissioner doing to bother you?"

"He slung Brule Inger into the brig yesterday morning." Brule was Trigger's young man, Holati recalled. "He'll be shipped home on the next supply ship. And I don't know," Trigger added, "whether Ramog wants Brule out of the way because of me, or because he really suspects Brule was out hunting Old Galactic artifacts on Project time. He wasn't, of course, but that's the charge. Either way I don't like it."

"People are getting mighty touchy about that Old Galactic business," Holati said. "Biggest first-discovery bonus the Federation's ever offered by now, just to start with."

Trigger shrugged impatiently. "It's a lot of nonsense. When the Project was moved out here last year, everyone was saying the Manon System looked like the hottest bet in the Cluster to make the big strike. For that matter, it's why Ramog got the Manon Project assigned to him, and he's been all over the planet with Essidy and those other stooges of his. They haven't found a thing."

Holati nodded. "I know. Wouldn't be at all surprised, though, if the strike were made right here on Manon eventually. It's in a pretty likely sector."

Trigger regarded him skeptically. "So you believe in those Old Galactic stories, too? Well, maybe—but I'll tell you one thing: it wouldn't be healthy for anyone but Commissioner Ramog to make that kind of discovery on Commissioner Ramog's Project!"

"Now, now, Trigger!" Holati began to look alarmed again. "There's a way in which those things are handled, you know!"

Trigger's lip curled. "A foolproof way?" she inquired.

"Well, practically," the S.A.C. told her defensively. He was beginning to sound like a man who wanted to convince himself; and for a moment she felt sorry for disturbing him. "You make a strike, and you verify and register it with the Federation over any long-range communications transmitter. After that there isn't a

thing anybody else can do about your claim! Even the . . . well, even the Academy isn't going to try to tangle with Federation Law!"

"The point might be," Trigger said bleakly, "that you wouldn't necessarily get near the transmitters here with that kind of message. As a matter of fact, I've seen a couple of pretty funny accidents in the two years I've been working with Ramog." She shrugged. "Well, I'm heading back to the Colonial School when my hitch here is up—I'm fed up with the way the Academy boys are taking over in Precol. And I've noticed nobody seems to like to listen when I talk about it. Even Brule keeps hushing me up—" She turned her head to a rattling series of clicks from the recorder, reached out and shut it off. A flat plastic box popped halfway out of the recorder's side. Trigger removed it and stood up. "Here's your signal pattern duplicate. Hope it works—"

While Holati Tate was helping Trigger Argee load her equipment back into her little personal hopper, he maintained the uncomfortable look of a man who had just heard an attractive young woman imply with some reason that he was on the spineless side. After she had gone he quit looking uncomfortable, since it wasn't impressing anybody any more, and began to look worried instead.

He liked Trigger about as well as anyone he knew, and her position here might be getting more precarious than she thought. When it became obvious a while ago that Commissioner Ramog had developed a definite interest in Trigger's slim good looks, the bets of the more cynical elements at the Bio Station all went down on the commissioner. No one had tried to collect so far, but Brule Inger's enforced departure from the Project was likely to send the odds soaring. While Ramog probably wouldn't resort to anything very drastic at the moment, he was in a good position to become about as drastic as he liked, and if Trigger didn't soften up on her own there wasn't much doubt that Ramog eventually would help things along.

Frowning darkly, Holati climbed into his own service hopper and set it moving a bare fifty feet above the ground, headed at a leisurely rate down the slopes of a long green range of hills toward the local arm of Great Gruesome Swamp. Two hundred miles away, on the other side of this section of Great Gruesome, stood the domes of Manon's Biological Station of which he was the head.

He had a good deal of work still to get done that evening, but he wanted to do some thinking first. Nothing Trigger had told him was exactly news. The Precol Academy group had been getting tougher to work with year after year, and Commissioner Ramog was unquestionably the toughest operator of them all. The grapevine of the Ancient and Honorable Society of Retired Space Scouts, which counted slightly more than twelve thousand members scat-

tered through Precol, credited the commissioner with five probable direct murders of inconvenient Precol personnel, though none of these actions stood any chance of being proved after the event. Two of the victims, including an old-time commissioner, had been members of the Society. Ramog definitely was a bad boy to get involved with—

The hopper began moving out over the flat margins of Great Gruesome, a poisonous-looking wet tangle of purple and green and brown vegetation, gleaming like a seascape in the rays of Manon's setting sun. There were occasional vague motions and sudden loud splashings down there, and Holati cautiously took the vehicle up a couple of hundred feet. The great chains of swamp and marshy lakes that girdled two-thirds of the planet's equator contained numerous unclassified life-forms of a size and speed no sensible man would have cared to match himself against outside of full combat armor. Precol personnel avoided unnecessary encounters with such brutes; their control would be left to the colonists of a later year.

His immediate problem was the ticklish one of establishing the exact circumstances under which Commissioner Ramog was to murder Holati Tate. It was an undertaking which could only too easily be fumbled, and he still wasn't at all certain of a number of details. Brow furrowed with worried thought, he kicked the hopper at last into a moderately rapid vertical ascent and unpackaged the bio-signal record Trigger Argee had transcribed for him. He fed it carefully into the hopper's broadcast system.

Floating presently in the tinted evening air of the lower fringes of Manon's aerial plankton zone, Holati Tate sat a while scanning the area about and above him. A few hundred yards away a sluggishly moving stream of the Drift was passing overhead. A few stars had winked on; and hardly a thousand miles out, a ribbon of Moon Belt dust drew thin glittering bands of fire across the sky. Here and there, then, Holati began to spot the huge greenish images of mankind's established competitors for the protein of the Plankton Drift: the Harvesters of Manon.

In a couple of minutes he had counted thirty-six Harvesters within visual range. As he watched, two of them were rising until they dwindled and vanished in the darkening sky. The others continued to hover not far from the streams of the Drift, as sluggish at this hour as their prey. The sausage-shaped, almost featureless giant forms hardly looked menacing, but three venturesome biologists had been electrocuted by a Harvester within a week after the Project was opened on the planet; and the usual hands-off policy had been established until Project work advanced to the point where the problem required a wholesale solution.

Holati tuned in the bio-receiver. Around midday both Harvesters and plankton were furiously active, but

there was only the barest murmur of signal now. He eased down the broadcast button on the set and waited.

He'd counted off eight seconds before he could determine any reaction. The plankton stream nearest him was losing momentum, its component masses began curving down slowly from all directions towards the hopper. Holati was not sure that the nearest Harvesters had stirred at all; keeping a wary eye on them, he gradually stepped up the signal strength by some fifty per cent. The hopper was a solid little craft, spaceworthy at interplanetary ranges, but he was only slightly curious about what would happen if he allowed it to accompany a mass of plankton into a Harvester's interior. And he wasn't in the least interested in stimulating one of the giants into cutting loose with its defensive electronic blasts.

The Harvesters were definitely moving toward him when the first streamers of the plankton arrived, thumped squashily upon the hopper's viewplate receivers and generally proceeded to plaster themselves about the front part of the machine. Blinded for the moment, Holati switched on a mass-scope, spotted an oncoming Harvester at five hundred yards and promptly stopped the broadcast. Somewhat nervously, he watched the Harvester drift to a stop while the butterfly-sized plankton life, dropping away from what had become an uninteresting surface again, made languid motions at clustering into a new formation.

He hesitated, then eased the hopper backward out of the disturbed area. A mile off he stopped again and swept his glance once more over what he could see of the gliding clouds of the Drift. Then he jammed down the broadcast button, sending the bio-signal out with a bawling force the planet had never experienced before.

Throughout the area, the Drift practically exploded. Great banks of living matter came rolling down through the sky toward the hopper. Behind, through and ahead of the sentient tides, moving a hundred times faster than the plankton, rushed dozens of vast sausage shapes, their business ends opened into wide, black gapes.

Holati Tate hurriedly knocked off the hopper's thunderous Lorelei song and went fast and straight away from there. Far behind him, he watched the front lines of the plankton clouds breaking over a converged mass of Harvesters. A minute later the giants were plowing methodically back and forth through the late evening snack with which he had provided them.

The experiment, he decided, had to be called a complete success. He got his bearings, turned the hopper and sent it arrowing silently down through the shadowy lower air, headed for Warehouse Center on the southern side of the local arm of Great Gruesome Swamp.

Supply Manager Essidy was a tall, handsome man with a small brown beard and a fine set of large white

teeth, who was disliked by practically everybody on the Project because of his unfortunate reputation as Commissioner Ramog's Number One stooge. Perhaps to offset the lonely atmosphere of his main office at Warehouse Center, Essidy was industriously studying the finer points of a couple of girl clerks through his desk viewer when he was informed that Senior Assistant Commissioner Tate had just parked his hopper at Dome Two.

Essidy clicked his teeth together alertly, lifted one eyebrow, dropped it again, cleared the viewer, clipped a comm-button to his left ear and switched the comm-set to "record." Of the eight hundred and thirty-seven people on the Manon Project, there were nine on whom the commissioner wanted immediate reports concerning even routine supplies withdrawals. Holati Tate was one of the nine.

Essidy's viewer picked up the S.A.C. as he walked down the central corridor of Dome Two and followed him around a number of turns, into a large storeroom and up to a counter. Essidy adjusted the comm-button.

". . . Not just for atmospheric use," Holati was saying. "Jet mobility, of course. But I might want to use it under water."

The counter clerk had recognized the S.A.C. and was being respectful. "Well, sir," he said hesitantly, "if it's a question of pressure, that would have to be a Moon-suit, wouldn't it?"

Holati nodded. "Uh-huh. That's what I had in mind."

Back in the office, Essidy lifted both eyebrows. He couldn't be sure of the Bio Station's current requirements, but a Moon-suit didn't sound routine. The clerk was dialing for the suit when Holati added, "By the way, got one of those things outfitted with a directional tracker?"

The clerk looked around. "I'm sure we don't, sir. It isn't standard equipment. We can install one for you."

Holati reflected, and shook his head. "Don't bother with it, son. I'll do that myself . . . Uh, high selectivity, medium range, is the type I want."

". . . That's all he ordered," Essidy was reporting to Commissioner Ramog fifteen minutes later, on the commissioner's private beam. "He checked the suit himself—seemed familiar with that—and took the stuff along."

The commissioner was silent for almost thirty seconds and Essidy waited respectfully. He admired the boss and envied him hopelessly. It wasn't just that Commissioner Ramog had Academy training and the authority of the Academy and the home office behind him; he also had three times Essidy's brains and ten times Essidy's guts and Essidy knew it.

When Ramog finally spoke he sounded almost absent-minded, and Essidy felt a little thrill because that could mean something very hot indeed was up. "Well, of course Tate's familiar with Moon-suits," Ramog said. "He put in a sixteen-year hitch with the Space Scouts before getting assigned to Precol."

"Oh?" said Essidy.

"Yes." Ramog was silent a few seconds again. "Thanks for the prompt report, Essidy." He added casually, "Keep the squad on alert status until further notice."

Essidy asked no foolish questions. The matter might be hot right now, and it might not. He'd hear all he needed to know in plenty of time. That was the way the boss worked; and if you worked the way he liked, another bonus would be coming along quietly a little later to be quietly stacked away with previously earned ones. Essidy looked forward to retiring from the service early.

Commissioner Ramog, in his private rooms at Headquarters, let the tiny beam-speaker slip back into a desk niche and shifted his gaze toward a slowly turning three-dimensional replica of Manon which filled the wall across the room. The commissioner was a slender man, not very big, with a wiry, hard-trained body, close-cropped blond hair and calm gray eyes. At the moment he looked intrigued and a trifle puzzled.

The obvious first item here, he told himself, was that there simply wasn't any spot on the surface of this planet where the use of a Moon-suit was indicated. The tropical lakes were too shallow to present a pressure problem—and the fauna of those lakes was such that he wouldn't have cared to work there himself without both armor and armament. He could assume therefore that Senior Assistant Commissioner Tate, having checked out neither armor nor armament,

wasn't contemplating such work either.

The second item: a directional tracker had a number of possible uses. However, it had been developed as a space gadget, and while it could be employed on a planet to keep a line on mobile targets, either alive or mechanical, it looked as if Tate's interest actually might be centered on something in space—

Nearby space, since the only vehicles available to personnel on Manon had a limited range.

Dropping that line for the moment, the commissioner's reflections ran on, one came to the really interesting third item—which was that Tate was an old-timer in Precol service. And as an old-timer, he knew that a requisition of this kind would not escape notice on an Academy-conducted Project. In fact, he could expect it to draw a rather prompt inquiry. One had to assume again that he intended to accomplish whatever he was out to accomplish with such equipment before an inquiry caught up with him—unless, of course, he had a legitimate explanation to offer when the check was made.

In any event, Commissioner Ramog concluded, no check was going to be made. At least, none of the kind that the senior assistant commissioner might be expecting.

Ramog stood up and walked over to the viewwall. There were two other planets in the system of Manon's great green sun. Giant planets both, and impossible for a man in a hopper to approach. Neither of them had a moon. There would be stray chunks of matter sprinkled through the system that nobody knew about, but Tate didn't have the equipment for a planned prospecting trip. He had the experience: his record showed he'd taken leave of absence a half dozen times during his Precol service period to take part in private prospecting jaunts. But without equipment, and the time to use it, experience wouldn't help him much in sifting through the expanses of a planetary system.

And that left what really had been the most likely probability almost to start with. The commissioner switched off the image of Manon and replaced it with that of Manon's Moon Belt.

The planet had possessed a sizable satellite at one time; but the time lay far in Manon's geological past. What was left by now was debris, thick enough to provide both a minor navigational problem and an interesting night-time display, but not heavy enough to represent a noteworthy menace to future colonists. So far there had been no opportunity to survey the Belt thoroughly.

But anyone who was using a hopper regularly could have made an occasional unobserved trip up there.

He couldn't, however, have left his vehicle. Neither to make a closer investigation, nor to pick up something he thought he'd spotted. Not unless he had a Moon-suit.

The commissioner felt excitement

growing up in him, and now he could allow it to come through. Because there was really only one reason why an old-timer like Tate would violate Precol regulations so obviously. Only one thing big enough! The thing that Commissioner Ramog had come to Manon to find. An Old Galactic artifact—

He noticed he was shaking a little when he switched on the communicator to the outer office of his quarters. But his tone was steady. "Mora?"

"Right here." A cool feminine voice.

"See what you got on Tate during the day."

"The S.A.C.? He was out with Argee for two hours this afternoon. No coverage on that period."

Ramog frowned a little, nodded. "I have her report here. A Project Five item. What else?"

"Afterwards — Warehouse Center . . ."

"Have that, too."

"I'm scanning the tapes," Mora said. And presently, "Seems to have been in his hopper alone since early morning. Location checks to his station. Nothing of interest, so far. Hm-m-m . . . well, now!"

"What is it?"

"I think," Mora told him, "I should bring this in to you. He's going to be gone two or three days."

"I'll come out." Ramog already was on his feet. "Get me a current location check on that hopper of his."

Mora looked around as he came hurriedly into the office. "No luck, commissioner. Hopper can't be traced. He's gone off-planet."

Ramog's eyes narrowed very briefly as he dropped into a chair at her desk. "Start up the playback. And don't look so pleased!"

Mora smiled. She was a slender, quick-moving, black-haired girl with big eyes almost as dark as her hair. "That's my little blond tiger!" she murmured.

His face was flushed. "What do you mean?"

"I mean," she said, "that I feel very, very sorry for the S.A.C." She started the playback. "The other one talking is Chelly. Ecologist. Tate's unofficial second-in-command at the station."

Ramog nodded impatiently. There weren't more than a dozen sentences to the conversation between Holati Tate and Chelly. Mora shut off the playback. "That's all there is to his tape." She waited.

Ramog had had a bad moment. The S.A.C. had simply put Chelly in charge of station operations for the next two or three days, until he returned. No explanation for his intended absence, and Chelly seemed only mildly surprised. But obviously he wasn't involved in what Tate was doing.

What had bothered Ramog was the sudden thought that Tate might have arranged for an off-planet rendezvous with an FTL. But a second or two later he knew it wasn't possible. The Precol patrol boat stationed off Manon would spot, report, and challenge

anything equipped with a space drive before it got close enough to the system for a hopper to meet it. The patrol-boat's job was a legitimate one: a planet undergoing orderly processing became a Federation concern and closed to casual interlopers. But in this case it insured that wherever Holati Tate was heading, he would have to return to Manon eventually.

The commissioner had relaxed a little. He smiled at Mora, his mind reverting to something she'd said a minute or so ago. A thrill-greedy, sanguinary little devil, he thought, but it would be regrettable if he ever had to get rid of Mora. They understood each other so well.

"You know," he told her, "I seem to feel very sorry for the S.A.C., too!" He added, "Now."

She gurgled excitedly and came over to him. "Are you going to tell me what it's all about?"

"Don't be stupid," Commissioner Ramog said tolerantly. An operation like this was a game to Mora. But she wasn't stupid. She was the most valuable assistant he'd ever developed.

"How many possible lines of action?" she persisted.

Ramog already had considered that. "Three," he said. "And I don't think we'd better waste any time."

As it happened, it was Ramog's third line of action with which Holati Tate became involved when he dropped back into Manon's atmosphere two and a half planet days after his departure. Had he set the hopper down then in some wild section of the planet it would have been a different story. Ramog had been obliged to consider the possibility that the S.A.C. would be so lacking in human trustfulness that he might bury some item of value where it would never be found by anyone else.

An electronics specialist by the name of Gision was, therefore, on Holati's tail in an armed hopper as soon as he was spotted again, and he followed the S.A.C. around the curve of the planet as unobtrusively as one hopper could follow another. However, Holati Tate was merely heading by the shortest route for his Bio Station. When he settled down there, Gision took up a position halfway between Headquarters and the Bio domes and waited for developments.

At the Bio Station Essidy took over. For the past eighteen hours Essidy had been conducting an unhurried inventory of the station, assisted by a small crew of husky warehouse men. Holati locked his hopper when he got out, and it wasn't Essidy's job to do anything about that. He merely reported to Ramog that the S.A.C.—looking a little travel-worn and towing a bulky object by a gravity tube—had gone to his personal quarters. The object appeared to be, and probably was, the packaged Moon-suit. A few minutes later, Holati re-appeared at the hopper without the object, climbed in and took off. Gision reported from his aerial vantage point that the S.A C. was going toward Headquar-

ters now and was told by Ramog to precede him there.

Essidy was chattering over the private beam again before Gision signed off. Holati Tate had left his quarters sealed, but that had been no problem. "We got the thing unwrapped," Essidy said. "It's the Moon-suit, all right, and nothing else. He's got the directional tracker installed. It's activated. And that's the only interesting thing in these rooms."

"Go ahead," Ramog said quietly. "What's the reading on the tracker?"

Essidy checked again to make sure. "Locked on Object," he reported. "At two to twenty thousand miles."

And that was all Ramog had wanted to know. For a moment he was surprised to discover that his palms were slippery with sweat.

"All right, Essidy," he said. "Seal up his rooms and bring the suit over here, immediately." He added with no change in inflection, "If anyone has tampered with that reading before I see it, I'll burn him and you personally."

"Yes, sir," Essidy said meekly. "Shall I have the boys go ahead with the inventory to make it look right?"

Ramog said that would be fine and cut him off. The commissioner was actually enormously relieved. His third line of action was unreeling itself smoothly, and even if Tate got suspicious and panicked now it wouldn't present a serious problem, though it might still make the operation a little messy.

One could even hope for the S.A.C.'s own sake, Ramog thought, smiling very faintly now, that he wouldn't panic. The third line of action was not only the least risky, it was by far the most humane.

Holati Tate set the hopper down a hundred yards from the Headquarters vehicle shelter entrance. The service crew chief's voice said over the intercom, "Better bring her in, sir. We're on storm warning."

Holati obediently turned the hopper, slid her into the shelter and grounded her. The entrance door closed a hundred yards behind him.

"Want her serviced, sir?"

"No, no; she doesn't need it." Holati set the hatch on lock, got out and let it snap shut behind him. He looked at the crew chief. "I'll be taking her out again in thirty minutes or so," he said. Then he walked off up the dome tunnel toward the office sections.

The crew chief looked around and saw the hopper's hatch open. He frowned.

"Hey, you!" He went up to the hatch. "Who's that in there? She don't need servicing. How'd you get in?"

The man named Gision looked out. He was a large man with a round face and a sleepily ferocious expression.

"Little man," he said softly, "just keep the mouth shut and take off."

The crew chief stared at him. Gision was tagged with a very peculiar reputation among the best informed Project personnel, but the crew chief hadn't had much to do with

him personally and he habitually ignored Project rumors. Rumors about this guy or that started up on almost any outworld operation; they could usually be put down to jumpy nerves.

He changed his mind completely about that in the few seconds he and Gision were looking at each other.

He turned on his heel and walked off, badly shaken. If something was going on, he didn't want to know about it. Not a thing. He wasn't an exceptionally timid man, but he had just realized clearly that he was a long way from the police of the Federation.

Mora was in temporary charge of the communications offices, though Holati Tate didn't see her at first. He walked up to a plump, giggly little clerk he'd talked to before. She was busy coding a section of the current Project reports which presently would perform some fantastic loops through time and space and present themselves briskly at the Precol Home Office in the Federation.

Holati looked around the big room. "Where's Trigger Argee?" he inquired.

The clerk giggled. "Visiting her boy friend—" She looked startled. "My . . . I guess I shouldn't have said that!"

So Holati discovered Trigger had been offered a special four-day furlough from the commissioner to go console Brule Inger in the brig, which was stationed in the general area of Manon's southern pole. He could imagine Trigger had been a little suspicious of the commissioner's gesture, but naturally she'd accepted.

He pulled down worriedly on his left ear lobe and glanced over to the far end of the room where three other clerks were working. "Who's in charge here, now?"

"Mora Lune's in charge," said the little clerk. She giggled. "If there's something . . . maybe I can help you?"

"Hm-m-m," Holati Tate said dubiously. As the little clerk told the others afterwards, he looked mighty nervous at that moment, hesitating as if he didn't know what to say. As a matter of fact, he felt rather nervous. "This Mora Lune," he went on at last. "Who's she?"

"The commissioner's secretary," explained the girl. "Mostly. She does all kinds of things, though. Sort of his assistant."

The S.A.C. stood stroking his chin and gnawing his lip. Finally he frowned.

"Well," he said with a sigh, "guess I'll go see Mora."

The little clerk giggled brightly and jumped up. "I'll show you to the office," she offered. Because, as she explained afterwards, she could just feel that something exciting was up.

That was all she had to tell. Mora sent her back to her work as soon as the two of them reached the door of the Central Communications Office. Mora didn't look excited except that her eyes had become nearly black. One would have had to know Mora to interpret that correctly, but

Holati Tate made a fair guess. Like a man who's reached a decision, he explained his purpose almost curtly, "I want to send a personal message by long-range transmitter."

Mora indicated restrained surprise. "Oh . . . you'll want privacy, I suppose?" She added, "And I'm sure you're aware of the expense factor?"

He nodded. Just getting the long transmitters started up came to around three months of his salary.

Mora looked arch. "Perhaps congratulations are in order? A registration?"

At that, Holati Tate chuckled nervously. "Well, I'll say this much . . . I'll want to use the Notary!"

"Of course." Mora rose from behind the desk. "I'll attach it for you myself," she offered graciously. She floated ahead of him down a short hall and into the communications cabinet, dealt deftly there with switches and settings, connected the Notary machine with the transmitter, floated back to the door. "It's expensive, remember!" She smiled at him once more, almost tenderly, and closed the door behind her.

"How'd he take it?" Gision inquired a few minutes later.

Mora shrugged. They were in her own office and both were bent intently over a profile map of the area. On the map a small yellow dot moved out from the sprawl of Headquarters domes toward the southern swamps. Gision's large thumb rested lightly on a button at the side of the frame. Map and attachments were his own creation. "He just clammed up completely when he discovered it was to be a canned message," she said. "Refused to make it, of course—said he'd be back tomorrow or whenever the transmitters were working again. But I'm not even certain he was suspicious."

Gision grunted. "You can bet he got suspicious! The transmitters don't cut out that often."

"Maybe. He'd already checked out positive on the Notary anyway. It was a registration, all right." Mora moved a fingertip toward the thumb that rested on the button. "If you let me do that, I'll tell you what he was going to register."

Gision shook his big head without looking up. "You're too eager. And I'm not interested in what he was going to register."

She smiled. "You're all scared of Ramog."

Gision nodded. "And so would you be," he said, "if you had any sense." They sat quietly a few minutes; then Mora began to fidget. "Isn't that far enough? He'll get away!"

"He can't get away—and it's almost far enough. We want him right out over the middle of those swamps."

She looked at his face and laughed. "I can tell you're going to let me do it. Aren't you?"

Gision nodded again. "And now's about the time. Put the finger up here."

She slipped her finger over the button and wet her lips. "Like this?"

"Like that. Now push."

She pushed down. The yellow dot vanished.

"Is that all?" she said disappointed.

"What did you expect?" Gision said. "An explosion?"

"No," Mora said dreamily. "But there's not much to it. If the old boy had been a little sharper, we might have had a questioning."

He shrugged. Sometimes Mora gave him the chills. "Questionings are what you try when you can't figure it out," he explained. "In a setup like this they can get pretty risky. So the boss likes to figure it out." He added his own basic philosophy, "When they're dead, they're safe."

Holati Tate was sweating under his clothes when he slid the hopper back out of the vehicle shelter entrance and lifted into the air. Actually, as far as he could tell, everything was rolling along very smoothly, and he could reassure himself with the thought that he was dealing with a group of people who appeared to have proved their competence at this sort of business more than once in the past. If their thinking was up to par, he would be quite safe for the next eight minutes.

But one couldn't be sure.

Somewhat shakily therefore, he gave the hopper its accustomed fix on the Bio Station and put it on automatic. Then taking a coil of wire out of his pocket, he slipped its looped end over the acceleration switch, secured the loop and gave the wire a tentative tug. The hopper responded with a surge of power.

Holati patted another pocket, which contained a package of emergency rations, and sat back to sweat out the remaining minutes. A persistent fluttering started up in the pit of his stomach. His gaze went wistfully once to the collapsed escape bubble on his left. He was getting a little old for field and track work, he thought; the bubble looked very attractive. But he had no way of knowing just how thorough Ramog's preparations had been, and no time to check. So the bubble was out, like the grav-tubes and the heavy rifle in the hopper's emergency locker. Field and track stuff, as if he were a downy cadet! He groaned.

Wooded stretches passed under him and Great Gruesome's lowlands moved into view ahead. Holati cut the hopper's speed to a crawl, dropped to twenty feet and opened the hatch. He edged out, breathing hard and hanging on to his wire with one hand, and as they passed over the first patch of marshy ground he gave the wire a firm tug and jumped. The hopper zoomed off, slanting upward again.

The ground was much wetter than Holati had estimated, but he floundered and waded out in three and a half minutes. A pair of hippopotamous-sized, apparently vegetarian, denizens of Great Gruesome followed him part of the way, bellowing annoyedly, but undertook no overt action.

As he sat down on the first piece

of dry earth to pour the mud out of his boots, there was a moderately bright flash in the noonday sky over the approximate center of the swamp-arm behind him. Holati didn't look around but he grunted approvingly. Clean work! Even if someone had been interested in going hunting for fragments of the hopper, they weren't going to invade the center of Great Gruesome to do it. Not very long.

He worked his boots back on, stood up, sighed, and set out squishly on what was going to be a two-day hike back to the Headquarters Station.

When the long-awaited announcement of the first artifacts of the legendary Old Galactic civilization finally was flashed from Precol's Manon System to the Federation, the Precol home office and Academy showed an uncharacteristic lack of enthusiasm. The fact that one of their most able and respected field operators had just been lost off Manon in line of duty might have had something to do with it. In the wave of renewed high interest in space exploration which swept the Federation, this detail remained generally unnoticed.

For the discovery was a truly king-sized strike. The riches of robotic information alone which it provided for a dozen interested branches of human science might take a century to be fully utilized. The Old Galactic base on an obscure planetoid circling far beyond the previously established limits of the Manon System was no dead relic; it was a functioning though currently purposeless installation. The best guess was that approximately thirty-two thousand standard years had passed since the constructors of the base had last visited it. Automatically and efficiently since then the installation had continued to reap and process the cyclic abundance of plankton life from Manon's atmosphere.

When the ships which once had carried away its finished products no longer came and the limits of its storage facilities were reached, it piled up the accumulating excess on the little world's lightless surface. But its processing sections remained active, and back and forth between the planetoid and Manon moved the stream of Harvesters, biological robots themselves, and performed their function until a human discoverer set foot on the little world and human hands reached for the controlling switches in the installation that turned the Harvesters off.

So scientists, technicians and reporters came out by the shipload to the Manon System, and for a few months Manon's new Acting Commissioner was an extremely busy man. One day however he summoned his secretary, Trigger Argee, to his new office on what was now popularly though inaccurately known as Harvest Moon and said, "Trigger, we're going for a little trip."

"You're scheduled for three more interviews in the next six hours," Trigger informed him.

"Chelly or Inger can handle them," the Acting Commissioner said.

"Not these," said Trigger. "Reporters. They want more details on the Space Exploits of the Gallant Scout Commander Tate in His Younger Days."

"Hell," Acting Commissioner Tate said, reddening slightly, "I'm too old to enjoy being a hero now. They should have come around thirty years earlier. Let's go."

So they rose presently from the surface of the dark worldlet, with Trigger at the controls of a spacecraft not much bigger than a hopper but capable nevertheless of interstellar jumps, though Trigger hadn't yet been checked out on such maneuvers. It was, as a matter of fact, basically the ferocious little boat of the Space Scouts rebuilt for comfort, which made it a toy for the fabulously wealthy only. The Acting Commissioner, having observed recently that, on the basis of his first-discovery claims to Harvest Moon and its gadgetry, he was now in the fabulously wealthy class, had indulged himself in an old man's whim.

"Here's your course-tape, pilot," he said complacently and settled back into the very comfortable observer's seat on Trigger's right, equipped with its duplicate target screen.

Trigger fed in the tape and settled back also. "Runs itself," she said. "Practically." She was a girl who could appreciate a good ship. "What are you looking for, out in the middle of the Manon System?"

"You'll see when we get there."

Trigger gave him a quick look. Then she glanced at the space-duty suit he had brought from the back of the ship and laid behind his seat. "I'm not so sure," she said carefully, "that I'm going to like what I see when we get there."

"Oho!" Holati Tate reached up and tugged down on his left ear lobe. He looked reflective. After a moment he inquired, "How much of this have you got figured out, Trigger girl?"

"Parts of it," Trigger said. "There're some missing pieces, too, though. I've been doing a little investigating on my own," she explained.

Manon's Acting Commissioner cleared his throat. He reached out and made an adjustment on his target screen, peered into the screen, muttered and made another adjustment. Then he said, "What got you going on an investigation?"

"The fact," said Trigger, "that Precol Academy seems willing to let you get away with murder."

"Murder?" He frowned.

"Yes. It didn't take much digging to find out about the Ancient and Honorable Society of Retired Space Scouts. First I'd heard of that outfit." She hesitated. "I suppose you don't mind my saying it doesn't sound like an organization anyone would take seriously?"

"Don't mind at all," said Holati Tate.

"I believe you. In fact, after I'd found there were around twelve thousand of those retired Scouts scattered through Precol—and that you happened to be their president—it occurred to me the Society might have selected that name so nobody *would* take it seriously."

"Hm-m-m." He nodded. "Yes. Bright girl!"

"There may be bright people at the Academy, too," Trigger said. "Bright enough to work out that Commissioner Ramog's departure from our midst was a well-planned execution."

"I'd say I like 'execution' better than 'murder,'" Holati remarked judiciously. "But it's still not quite the right word, Trigger girl."

"You prefer 'object lesson'?"

"Well . . . that'll do for the moment. So what did you mean about it's being a well-planned object lesson?"

Trigger shrugged. "Wouldn't it have been a remarkable coincidence if you'd made the Old Galactic strike at just the right instant to help close out Ramog's account?"

"I see." Holati nodded again. "Yes, you're right about that. A few of us discovered Harvest Moon almost three years ago, on a private prospecting run—" He leaned forward suddenly. "Brake her down, pilot! There's a flock of those Harvester things ahead right now. I want to look them over."

She brought the ship to a stop in the middle of a widely scattered dozen of Harvesters, drifting idly through the system as they had been doing since Holati Tate had dis-

connected the switch that energized them, in an airless underground dome on Harvest Moon, three months before.

Peering out against the green glare of Manon's sun, Trigger eyed the nearest of the inert hulks with some feeling of physical discomfort. It was very considerably bigger than their ship, and it looked more like some ominously hovering dark monster of space than like an alien work-robot. She became aware that her companion's hands were moving unhurriedly about an instrument panel on the other side of his target screen. Suddenly, first one and then another of the Harvesters was glowing throughout its length as if a greenish light had been switched on inside it. The glow darkened again, as the invisible beam that had been scanning them from the ship went on to others of the group.

"Looks like this bunch was about four weeks out from Manon when the power went off," Holati remarked conversationally. He cut the scan-beam off. "It would have taken them close to two months to make the run to Harvest Moon at the time."

Trigger nodded. "I've seen the figures. Shall I get us back on course?"

"Please do. There's nothing here."

Trigger remained silent until she had gone through the required operations. Then, feeling unaccountably relieved at being in motion again, she said, "I suppose it was your Society that started the rumors about the Manon System being the most likely place for an Old Galactic strike to be made."

"Uh-huh. Sound data back of the rumors, too. We felt that with a sharp operator like Ramog the situation we set up had better be genuine." After a moment, he added, "There really wasn't any way of doing it gently, Trigger girl. That Academy outfit was too cocksure of its position; it needed hard processing. One of the things they had to learn was that—away from civilization, anyway—the members of the Society can play rougher and dirtier than any commissioner they can send out. After all," he concluded mildly, "we've had the training for that. Years of it."

Trigger looked at him curiously. "What puzzles me is that they seem to have got the idea so quickly. I wouldn't have thought Precol Academy would let itself be impressed too much by just one—object lesson."

"They might have missed some of the implications," Holati admitted. "However, we gave them a helpful hint."

"Oh?" she said. "What?"

"A formal complaint from our Society, signed by its president. It listed Society members and others who had been killed on Precol Projects in the last ten years, because of the inefficiency, let's say, of specific Project commissioners. The commissioners in question—all members of the Academy—were also listed. Ramog's name happened to be at the head of that list . . . and they got the

complaint the day after Ramog was reported lost."

Trigger's eyes widened. "Well," she acknowledged, "that's as broad as a hint can get!"

"We weren't trying to be subtle. Murder gets to be hard to prove under Project conditions—there're too many possibilities. So the Academy group is safe enough that way; we aren't accusing anyone of anything worse than inefficiency. But the complaint suggested that the people we listed be withdrawn from active service, as they were obviously unfit for such work."

She smiled briefly. "And since the Society has taken the precaution of turning its president into an extremely famous man, the home office can't resort to obvious counteraction—like firing the whole twelve thousand of you from the various Projects?"

"That would raise a terrible stink, wouldn't it?" Holati said cheerfully. "And, who knows, we might even publish our complaint then. With additional data we could— Slow her down again, will you? We should be pretty close to course end by now."

"A few minutes off," Trigger said reluctantly. "What is it—more Harvesters?"

He was fiddling with the target screen again. "Uh-huh," he said absently. "But we'll move on a little farther. Slow and easy now!"

Trigger kept it slow and easy, ignoring the dark shapes they slid past occasionally. After a while, she said, "There's one thing the Academy must have thought of trying, though—"

"To pin Ramog's disappearance on me?"

She glanced at him. "Perhaps not on you personally. There's evidence enough you'd just started walking back from the edge of the swamps when Ramog climbed into a jet suit, took off for the Moon Belt on an undisclosed mission, and vanished. But it wouldn't be too unreasonable for the Academy to assume that some retired, but not so decrepit Space Scouts, were waiting for him up there when he arrived."

"You know," Holati said with some satisfaction, "that's exactly how they did figure it." He kept his eyes on the screen as he went on. "Naturally, they wouldn't expect us to leave a body floating around, but a really capable investigator doesn't need anything as crude as that in the line of evidence. The Academy had some very good boys combing over the Moon Belt and other parts of the system the past couple of months. There were times when we had to be careful not to trip over them."

"Oh?" said Trigger. "What did they find?"

"Nothing," Holati said. "Naturally. They gave up finally."

She frowned. "How do you know?"

"I get the word. The word I got last week was that the bad eggs in Precol we named on that list are resigning in droves and heading for the Federation. And the men that

are being moved up are men we like. Just today," he added, "an Academy courier came in with an official notification for me. I'm confirmed in rank as commissioner now, in permanent charge of the Manon Project."

Trigger Argee sat thoughtfully silent for a while. "So there really wasn't anyone waiting up in the Moon Belt for Ramog?"

Holati shook his head. "No," he said almost casually. "We never laid a finger on him. Wouldn't have been quite ethical—we had no proof."

Her face began working curiously. "And there was that plankton beep you had me copying for you— Did you ever find out whether it attracted the Harvesters, too?"

He nodded. "Chow call, pure and simple. Now, pilot, do you spot that singleton on your screen over there?"

Trigger's head was swimming for a moment; then she saw the distant dark blob. "Yes," she said faintly.

"Move in on it, adjust to the drift, and stop." She heard him stand up.

"Holati!" It wasn't much more than a gasp. "Are you going out?"

"Well, what else? It won't take long."

Trigger closed her eyes slowly, opened them again and grimly maneuvered the sluggishly gliding boat in on its dark target. From behind her came a series of vague metallic sounds, followed by the snaps of the magnetic suit clamps. She stopped the boat and stared out at the shadow shape swimming like a whale in the tides of space beside them. Soft heavy footsteps passed behind her, moving toward the lock. Waves of horror began crawling over her skin.

The lock hissed, and presently stopped hissing. She was alone. The boat turned slowly, and she found herself staring again at the green blaze of Manon's sun. But the dark thing still floated at the edge of her vision, and now and then it seemed to move slightly. She felt like screaming. Then the lock began hissing again, and stopped again.

He came in slowly and turned to the back of the ship. Something went dragging and bumping heavily across the floor behind him.

She nodded slowly, though he couldn't see that from the back of the ship.

Riding a directional beam, she thought—and the beam pre-set to cut out when he hit the altitude where the Plankton Drift is thickest. So there he hangs wondering what's happened, while the suit is broadcasting to those—*whew!*

"Holati," she said evenly, "I think I'm going to faint."

"Not you," his voice came from the back of the ship. "Or I wouldn't have picked you for the trip." He was breathing heavily. "You can start us back to base now."

Trigger didn't faint. The ship began to move and the thing outside vanished. The thing he had brought inside went with them. Holati made no stir for the moment; she guessed he was glad of a chance to rest.

The happy little monster is right, her thoughts ran on. It wasn't a murder; it wasn't even an execution. They couldn't prove Ramog was a killer, so they tested him. He couldn't climb into that suit until he'd got Holati Tate out of the way. And once he'd done that, he couldn't send anyone else because, with stakes that big there was never anyone else a man like Ramog could trust.

The Society had it set up, all right—

There was a loud metal clang from the back of the ship, and a pale purple glow grew in the dark behind Trigger. The little fuel converter door had been opened. At the same time, something seemed to shut off her breathing.

Holati said conversationally, "Precol Service was a pretty fair organization before the Academy took over, Trigger. Shouldn't be long before it's back in good shape again now—" He stopped and grunted with effort, and there was a sharp cracking sound like a stick of dry wood being broken.

"The Academy's all right," he went on, breathing unevenly again, "for raising funds and things like that. We'll keep it around. But it's out in the field where the fun is, and we intend to keep the fun clean from now on."

The purple light faded; the converter door clanged shut. The little boat's interior lights came on. "All right," Holati said. "You can look around now."

Trigger looked around. There were dark streaks on the floor before the converter door, but the thing that had been brought in from outside was gone. Holati Tate was climbing out of his space-duty suit. He looked at her and closed one eye in a wink that was not, in the slightest degree, humorous.

"Processed!" he said.

THE END

THE ANALYTICAL LABORATORY

With six stories sharing the votes this time, the point-scores tend to run higher—and the probability for ties is less. There were a lot of letters this time—the Interplanetary Exploration Society editorial drew a lot of mail; as of this date, some three weeks after the magazine reached the stands, there have been just over two hundred subscriptions to the proposed Journal. The magnitude of that response to the first published offer of something so speculative as that journal of a Speculative Society is really remarkable; I want to thank you readers. And I'm certain we'll have that Journal rolling within six months now!

(*Continued on page* 85)

INTERVIEW

BY DANIEL LUZON MORRIS

Personally, I'm not quite certain: Is this a fantasy story, or a philosophical article?

Illustrated by Freas

Many old landmarks have disappeared in recent years under the pressure of road-widening schemes. One such plan, which has caused more than the usual stir, is for the widening of the road at the eastern entrance of the by-pass enabling travelers to avoid the town center of Carmarthen and its narrow and congested streets. This, apparently, will involve the removal to another site of the historic Priory Oak which is said to have been planted by Merlin.

The Manchester Guardian Weekly
June 20, 1957

ERLIN looked up: "Well shut the door," he said testily, "the draft is cooling my brew."

I went back and closed the door. I had felt foolish as I walked past the surveyors' stakes up to the dead trunk. The thumb-latch below the bronze plaque had startled me. But when I opened the section of silvered bole to find myself in a large, well-lighted laboratory I was so dumfounded that I simply stood, letting the door swing.

The homely act of closing a door calmed me a trifle, and I dared look at Merlin as I turned back. Except for the heavy white beard that covered the lower half of his face, he was the same man who had faced me yesterday across the counter of the electronics store—that one had been clean-shaven—or to whom I had talked at the Medical School last week—who had had a neat mustache. He wore a short-sleeved slipover shirt, and his apron, that might have been of plastic or well-worn leather, enclosed him from the waist nearly to the floor, giving him somewhat the look of a tree trunk himself. His mouth and eyes both wrinkled deeply at the corners as he smiled at my bewilderment.

"Come and help me with my spell. I can do it alone, but with two we'll be done in half the time:

" 'Double, double toil and trouble:
Fire burn, and cauldron bubble . . .' "

He snapped the switch of the electric stirrer, and the brew in the stainless-steel kettle began to move as we intoned the words. Greasy curls appeared in the surface of the thick liquid. Gobbets of gray gelatinous matter drifted slowly toward the shaft of the stirrer, to be sucked suddenly down with the gurgling, drowning-man gulps that only a rotary stirrer can produce.

" 'Gall of goat and slips of yew
Sliver'd in the moon's eclipse . . .' "

The brew became thinner and thinner; the sucking noises were more frequent now. Clouds of evil-smelling steam rose from the pot, and Merlin, still intoning, glanced at a thermometer held by a clamp at the side. With no break in rhythm he turned down a rheostat knob on the side of the stove below.

" 'Add thereto a tiger's chaudron
For the ingredients of our cauldron.' "

And he snapped off the stirrer switch.

"Interesting how faithfully Shakespeare recorded those spells. Remarkable man. He saw the process only

once, as I remember it, yet the words he quoted are accurate enough so that they still work as well as any."

He ladled out a sample of the liquid, touched the corner of a square of paper to it and dumped the rest back. He held the square of paper, now colored at the corner, to a light:

"About sixty-seven per cent free amino nitrogen, and it took fifteen minutes. How long do you suppose it would have taken without the spell?"

Finding my voice, I said, "That would depend on what was in it—particularly how many of those ingredients of Shakespeare's."

"Oh, not all of them. Actually, it's mostly sour milk and tuna fish guts. But some of the others seem to activate the enzymes."

I did a rapid run-through of the biochemistry I remembered:

"Even if there was a lot of trypsin in those fish guts, you couldn't do it in less than two or three days."

"Exactly. Surprising what a few words will do. Always supposing they are the right words."

"Excuse me, sir," I said, "but as accomplished a scientist as you must be"—I had been looking around the laboratory as we worked—"you don't believe that words have a real effect on things!"

"Oh?" said Merlin. "Haven't I heard that your brother is a communist? He's been working with that crowd at the University. I hear it's due to be investigated by Congress. Bunch of eggheads that do nothing but dream about economics, while the Kremlin dictates every word they publish. I wouldn't be surprised if you were one, too. Weren't you out last week with Mandy Merriss? A communist and a—"

Startled under his torrent of words I felt my face flush.

"Look here, you may be a magician, but you're a damn liar. Mandy M—"

He snapped, "What's your blood pressure right now, do you think? You say words have no effect? The words may have changed, true." He smiled now, and his smile had a peculiarly relaxing effect. My heart stopped thudding.

"In a slightly earlier time, think of the effect on a man who was told, 'Cursed shall you be in your goings-out and your comings-in. Every enterprise of yours shall fail. You will be smitten with wasting, and fever and ague, with burning heat, with blight and mildew, hunting you to the death. You will be smitten with the Egyptian scab, and the itch; there shall be no curing you. You will be driven distracted, crazed in your wits, groping your way at noonday like a blind man in the dark. Wed a wife and another shall bed her; work the land and another shall harvest . . ."

"All right, stop!" I could feel the short hairs crawling on the back of my neck. "But you're way off the point. It's psychological effects you're talking about now."

"So your blood pressure rise wouldn't show on a manometer? What is a psychological rise in pressure?" His thick eyebrows lifted.

"But I'm a living organism. So was the man who was injured by a curse like that."

"Hm-m-m. And where are you now drawing the line between the living and the nonliving? What's a virus? What's an enzyme? Where are you putting nucleotides this year? As for psychological effects, does a paramecium think? What is the status of research on that?

"No, I'll go on using my spells. Experimentally, they seem to work." He glanced down, "What's that you've got in your hand?"

I turned the volume control of my little portable radio. Raucous sounds of a very poor dance band swelled, and I cut them off fast. They didn't belong in this place, or in the presence of this austere man. Merlin held out a hand.

"Let me see it."

He touched the back, his fingers moving too fast for me to see exactly what he did. But the back came off, to reveal the printed circuits connecting the transistors.

"You people have come a long way. I've been reading of these things. Mine is an older model."

He pointed to a sword hanging on the wall.

"Some of the poets who wrote about singing swords had heard them. The poets you can read now must be content to have read about them. When a man of those times carved runes on a sword—if he knew his business—it picked up the music of the spheres themselves. I know, I know: celestial spheres are long outdated. Do you think they are any the less beautiful if you call them the star-molded curves of space-time?"

He looked again at the printed circuit.

"No symmetry. No true beauty. Small wonder that only the ugly is clearly received, the beautiful distorted. Look at my sword."

He took the great blade down, straight, weighty, razor-edged. The hilt was leather-wrapped, feeling live and warm as Merlin put it in my hand. Just below the guard began letters carved deep into the steel. Not Latin letters. They made patterns as well as words, running down the length of the blade toward the middle, to return again in beautiful confusion. There were vinelike tendrils and harsh cross-shaped cuts, flowing curves and angular corners.

"Stroke it," said Merlin, handing me a piece of chamois skin.

I placed the point on the table, and gingerly rubbed a pad of leather the length of the blade, expecting perhaps to hear something like the note of a metal gong. A single deep tone filled the air of the room, followed immediately by a full resounding chord. Then, quickly dying, the retreating sound of a haunting melody.

"It sang when its owner drew it from the scabbard. Sometimes the singing blade of a truly virtuous knight could vanquish a devil on the spot, before a blow had been struck."

As he reassembled my radio he said, "Yes, this is ugly, but you are

advancing. A few years more, given some understanding of the place of beauty, and your runes will be the equal of anything man has done before."

There was an awkward silence before I brought up my next question. I think he knew what I was going to ask.

"Do you mind if I ask how far back you go, sir?"

"That's better put than most." He smiled. "I go back well beyond the answers to any questions you would know how to ask. Does that tell you anything? An exact figure in years, even a round figure, I can't give you. It makes so much difference where you stand, and how fast you're going. I've never calculated the length of my space-time line, and that is the only thing that has any real meaning, as you have now discovered.

"Speaking of dimensions, though, do you know of the interesting case of ancient times where two different ideas—no, three, really—were well confused in one problem? It has come down as the 'problem of the duplication of the cube.' "

I had some vague idea of it: "Wasn't that Archimedes, or somebody around that time?"

"No, much earlier than Archimedes. Philoponus of Alexandria, whom you can read now, put it at about 430 B.C. He had it that there was a plague of typhoid, and the oracle at Delos told the people that the plague could be cured if they doubled the size of the altar to Apollo, which was in the shape of a cube. They tried to obey the oracle, but it didn't cure the plague."

He closed his eyes for a moment, and shuddered. "It certainly didn't. Actually the thing happened on a little island in the Aegean, about three hundred years earlier. I happened to be in the neighborhood. The increase in the size of the altar was supposed to double the volume. Plato and his friends—and probably Archimedes, too—later found various geometrical solutions to the problem in cube roots that that posed. But the people on the island built the new altar with twice the *dimensions*. There was a good deal of uranium in the stone they used. The island disappeared."

He shook his head. "If they had built the altar they were supposed to build, it would have done a good job on their plague."

I must have looked doubtful. Almost fiercely, he went on.

"Why do you think the ancient religions had clear regulations about their altars? Look at the specifications in Exodus: the altars that were to be made of stone that no tool had touched: no metal! There were the Greek altars which no woman might approach: effects on the germ-plasm of women were more obvious than those in men.

"In almost all religions the lore of the altar is basic. The altar is the dwelling place of the god. The man who approaches it in the right way is blessed; in the wrong way is

cursed. You people have seen as far as neutrons, even if neutrons aren't the whole story. You're beginning to realize that sizes and shapes and locations may have a significance all their own. That much you recognize, even if you aren't willing to re-admit the spoken word, except in the religious ceremonies that many of you consider merely symbolic.

"The priests in your churches place a wafer of wheat on the altar. The proper ceremonies are performed, the proper words spoken. And the faithful eat and are strengthened.

"Your physicists place a wafer of cobalt on an altar of another kind, well knowing the curse that will come on the man who approaches *that* altar unprepared. The hallowed cobalt wafers are then distributed to your centers of healing, being treated along the road with a reverence that would have flattered Apollo himself. There they heal such diseases as a god's blessing has always healed: foul diseases of the skin, wasting diseases, issues of blood, maladies that an earlier and sometimes wiser generation knew as the curses of malevolent spirits.

"And, as people have always done, you continue to worship the gods who seem able to do the most for you in material matters. As always, it is only a small minority who carry on the worship of the One God, Who must be worshiped in spirit and in truth. His following is small, except in those tragic times, returning again and again through the ages, when He is confused with others. Again and again I have seen the pitiful sight of the masses kneeling at the dangerous altar of the one true God while they worshiped Moloch and Mammon and Aphrodite. Worshiping the gods who could and did give them what they thought they wanted, in the very presence of the God Who gives Himself."

He stood heavily, brooding, his chin buried deep in his beard. Then he gestured toward the pot that was still gently steaming in the middle of the room.

"Already you are beginning to worship the fire that heats my pot. In another generation you may use it as your servant, if only your worship of it as your god doesn't destroy you first. Here, help me."

Together we lugged the great pot off to a table at the side of the room, and returned to the stove it had sat on.

"Watch," said Merlin.

He turned the rheostat knob to its full ON position. Almost at once I felt the glow of heat from the metal surface. It changed color, gray to dull red to cherry to crimson, before Merlin turned the knob off again. With yard-long tongs he removed a section of the cover. Light from overhead shone down into the interior to show—nothing: an empty fire pot of some sort, lined with refractory which still glowed red, shimmering in the convection currents.

I said, "Turn it on, and let me see the flame."

He shook his head. "No, it would

destroy your eyesight; but turn your back, and look at your shadow on the wall."

I turned as he ordered, heard him move, and saw the shadow of my head spring into being on the wall thirty feet away. At the same time I felt a blast of heat on my back. I was struck first by the remarkable sharpness of the shadow. Then as my eyes adjusted to the new brilliance in the room I saw that the shadow of every hair of my head was clear, distinct and thick—the source of the light and heat must have been a tiny point, very much smaller than a single hair. I started to turn, and the light died as suddenly as it had come on. The stove was only shimmering red by the time I could look at it.

"You'll have an uncomfortable sunburn as it is," Merlin said.

Again he stood heavily, gazing at the cooling metal.

"The people of Sodom and Gomorrah worshiped their fiery gods. They were swallowed in the flaming earth. Ancient Biblical superstition, many of you say."

Suddenly his head came up. The wrinkles came back to the corners of eyes and mouth.

"Well, young man, this is my interview. The bulldozers will be here tomorrow. You were lucky to find me in today. Write me up if you dare!"

THE END

THE ANALYTICAL LABORATORY

(*Continued from page* 78)

But here is the An Lab report on the June issue:

PLACE	STORY	AUTHOR	POINTS
1.	Heir Reluctant	Robert Silverberg	2.43
2.	Close to Critical (Pt. II)	Hal Clement	2.93
3.	No Connections	Randall Garrett	2.96
4.	Space To Swing a Cat	Stanley Mullen	3.26
5.	The Law School	Theodore L. Thomas	4.04

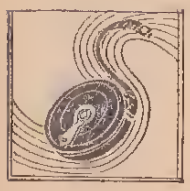
And despite six stories, and an unusually large number of letters, it took the third digit to break a near-tie for second place!

THE EDITOR.

THE EVOLUTION OF THE STARS

BY ALASTAIR CAMERON

With the development of engineering nuclear devices, our understandings of the natural nuclear reactors has shifted greatly. Stars, it seems, grow hotter, not colder, with age!



SCIENCE-FICTION readers tend to be a very nostalgic bunch of people. We treasure the memories of a few stories written many years ago and wonder why nothing equal to them is written today. When rereading such stories we try to recapture a remembered charm and to overlook the fact that the scientific background of many of them has become obsolete.

That is particularly true of stories familiarly called "space operas." Most of the better space novels were written ten or more years ago, before the emphasis in so much of the better science-fiction writing changed to themes which extrapolate the psychological and sociological sciences. Meanwhile there have been some drastic changes in our concepts and knowledge of the universe, the galaxy, and the solar system in which we live.

The astronomical sciences have been in great ferment. They have been stimulated by the development of revolutionary new instruments such as radio telescopes, sensitive and photoelectric photometers, and they have been enriched through the application of new ideas in physics and chemistry to cosmic problems. The writer who wants to compose a good space novel today is subject to a much stricter discipline from the new astronomical knowledge, but his scope is greatly widened by this knowledge.

There have been two traditional mechanisms used by many authors to destroy people on earth through misbehavior on the part of our sun. In the first of these, the sun grows old and cool and the earth gradually becomes a frozen waste. The second mechanism involves the other extreme: the sun becomes a supernova and all life is destroyed within a few hours. It now appears nearly certain

that neither of these pictures is correct, but that we must face a slow heat death.

A fascinating variety of stars exists in space. It is very likely that a large fraction of them are accompanied by planets. However, the science-fiction writer should resist the temptation to put populated planets revolving around most of the unusual specimens, unless the populations are very highly advanced in technology. These interesting stars are usually evolving very rapidly from one form to another, and only a civilization with tremendously greater control over its environment than we have on earth could cope with these changes.

A few stars are a million times as bright as the sun. Many stars are a million times fainter than the sun. This represents the extreme spread in stellar luminosities: most stars lie in-between the extremes, although in fact, most of them are fainter than the sun. This vast range of brightness is closely correlated with the masses of the stars, but here the range is much smaller. The factor of one million change in luminosity is caused by a change of only about a factor twenty in the mass. Since the stars get most of their energy from nuclear reactions which take place in their interiors, it may be seen that enormously different rates of evolution must be associated with the different stellar masses.

Let us pick a star with only about 1.3 times the mass of the sun and examine its evolution in some detail. Let us further suppose that this star was formed about six billion years ago, which would make it one of the oldest stars in the galaxy. For convenience, we will name it Hercules.

Astronomers are still very uncertain about the nature of stellar births. About two per cent of the mass of our galaxy exists in the form of gas and dust in the space between the stars. This fraction was probably greater six billion years ago. It is known that stars are currently being formed from this interstellar medium. Numerous examples have been identified as "associations" of bright stars in which the individual members are moving away in all directions from a common point of space. When these motions are projected backwards, it is found that the stars were in the vicinity of that common point at a common time which usually lies between one and ten million years ago! However, it is not known whether stars must always be born in groups or whether they can be formed singly. Most of the clusters which do form are so small that they are quickly broken up by the action of the gravitational tidal field of the galaxy and by encounters with the gravitational fields of passing stars.

So let us pass over the mysteries of Hercules' birth pangs. Somehow, he has been formed by a local condensation of the instellar gas and dust. For a baby with his mass, this condensation has taken about twenty million years. The infall of material has released a great deal of energy in his

interior, just as the flow of water over a waterfall releases energy which can be converted into electricity if the water is passed through a turbine. Some of this energy is stored as internal heat, raising the temperature at the center of the star, and the rest of the energy is radiated into space.

But Hercules is very hungry for energy. Heat continues to flow from his hot center to his surface, where it is radiated away. This cools the gases at his center, and they can no longer support the huge weight of his overlying mass. Hence, a further contraction of gases takes place, releasing more energy and raising the temperature at the center higher than before. At these high temperatures, which soon reach several millions of degrees Centigrade, the atoms in the interior become stripped of their electrons, and the atoms and electrons can be packed together at very high densities. The centers of stars like Hercules are commonly one hundred times as dense as water. Yet the atomic nuclei and electrons at the center of the star still behave like a perfect gas, because individually they occupy much less space than the original atoms did.

It is only possible to follow Hercules' life history in some detail because the laws of physics which describe conditions in his hellish interior are much simpler than those needed to describe the behavior of almost any other physical system on earth. In order that Hercules may be a well-behaved star, the temperature at any point in his interior must be high enough so that the pressure of the gas and the internal radiation can support the weight of the mass lying above that point. This weight can be calculated from the law of gravitation. Energy can flow from the center toward the surface in two ways. In regions of the star where the temperature increases very rapidly towards the center, the hot gases carry energy away from the high-temperature region by large-scale motions. In other regions, energy is transported by the continual absorption and reemission of radiation. The rate at which this occurs can be calculated from modern quantum mechanics. Energy generation in the star is governed by the law of conservation of energy and takes two forms. The contraction of the star converts potential energy into heat energy. Nuclear reactions produce heat at the expense of nuclear mass, and the rate at which this occurs can be found from experimental and theoretical nuclear physics. Put all these laws into a giant computer, stir gently with a few mathematicians, and out comes the biography of Hercules.

Hercules obtains a bit of a rest from the process of contraction when the temperature at his center rises to one million degrees Centigrade. At this point, thermonuclear reactions consume the internal deuterium, which is the heavy isotope of hydrogen. But there is not much deuterium in the star, and the respite does not last long. Hercules contracts again, and his central temperature continues to rise. He scarcely notices it when

thermonuclear reactions destroy the elements lithium, beryllium, and boron in his interior because the abundances of these are small, even compared to that of deuterium. Altogether, Hercules gains perhaps ten million years of energy generation from all these nuclear reactions.

However, when his central temperature rises to about seventeen million degrees, Hercules really hits the jackpot. At this point, a series of nuclear reactions sets in which converts hydrogen to helium. Since hydrogen forms the overwhelming bulk of the mass of the star, the energy released from these reactions is sufficient to keep Hercules in a nice stable configuration for a very long time—for about five billion years, in fact. Hercules is now called a "main sequence" star. Because the distribution of the energy release in his interior is somewhat different from that accompanying gravitational contraction, Hercules rearranges his structure slightly when he begins his main sequence existence, and he shines slightly less brightly than he did during the contraction phase.

If any planets have formed around Hercules, they will have taken all of the time during the contraction phase, and perhaps more, to consolidate themselves from spatial debris. If any of them is to develop earthlike conditions capable of supporting life-as-we-know-it, then long ages must pass in preparation. Low density rocks must be exuded to form continents. Water and air must be expelled from volcanoes. The long slow development of life will require billions of years before intelligent beings can be produced. Five billion years is not excessive for this process—the earth is 4.5 billion years old. Stars much more massive than Hercules will almost certainly pass through their main sequence stages too quickly for intelligent life to develop on their planets.

Toward the end of this five billion year period, Hercules starts to become uncomfortable. Nearly all the hydrogen at his center has been converted into helium by thermonuclear reactions, and energy is not liberated quite so easily there. Hercules must contract a bit and raise his central temperature in order to maintain his customary standard of living. In doing this, he starts to shine a little more brightly. Our own sun, though slightly less massive than Hercules, appears to have increased its energy output by about fifty per cent since it settled down as a main sequence star 4.5 billion years ago. This has raised the average temperature at the earth's surface quite noticeably—about 30°C—during this period of time, with no doubt, important effects on the evolution of life.

After five billion years, Hercules' main sequence days are over, and not again until the end of his life, will he lead so placid an existence. About ten per cent of his mass has been converted to helium. No more energy generation takes place at his center which is now exhausted of hydrogen. He must contract once again in order

to maintain his rate of energy production.

But this contraction does not go on very long before the gas surrounding the inert core of the star is heated to quite high temperatures—about thirty million degrees. This gas still contains lots of hydrogen, and under these conditions the hydrogen "burns" to helium in a thin shell surrounding the stellar core. There is a great deal of hydrogen in the star available for energy generation in this way, but it does not last as long as one might think, because Hercules is now shining quite a bit more brightly than before, and it is necessary to stoke his nuclear furnaces much more rapidly in order to satisfy his hunger for energy. The shell source of energy production moves outwards through the star, adding inert material to the core as it goes.

Hercules finds this situation rather uncomfortable, and the laws of physics demand that he undergo a marked change in his internal structure. The inert core contracts, raising the central temperature of the star a little. However, a really spectacular change occurs in the outer envelope of the star. This expands to many times its former size, and the star will engulf its innermost planets, if it has any. Hercules now has an enormous surface area through which is emerging about the same total flow of radiation as before the expansion. The temperature of this surface therefore falls quite low, about 2,000 or 3,000 °C. Hercules now has a very red complexion, and in fact he is now called a "red giant" star.

Hercules' outer envelope may now be spectacular to behold, but the properties of the gas at his center are even more spectacular to contemplate. His central regions have attained a density of ten thousand to one hundred thousand times that of water. Under these conditions, the electrons start to become stubbornly resistant to compression. We say that they now form a "degenerate gas." They get their peculiar properties as a consequence of Heisenberg's Uncertainty Principle in modern physics which in the present instance states that if a lot of electrons are to be packed into a very small volume, then most of the electrons must have very high energies. It takes a great deal of weight from overlying layers to cause further compression of these electrons. Indeed, if the star has a mass less than about 1.25 times that of the sun, the degenerate gas can support the weight of the overlying layers indefinitely, and no further energy would be generated by shrinkage. This is the basis on which white dwarf stars are constructed.

An ordinary gas cools when it expands and heats when it contracts. This provides a good safety valve in ordinary stars. Thermonuclear reactions are very sensitive to the temperature. If a thermonuclear reaction starts to run away at the center of an ordinary star, the gas becomes hotter and expands. This expansion drops the temperature until the thermonuclear reaction is quenched.

But a degenerate gas works just the opposite way! It heats when it expands and cools when it contracts. This gas is, therefore, highly unstable when the temperature rises sufficiently to start thermonuclear reactions in it.

Hercules continues to convert hydrogen into helium throughout the red giant phase of his existence until about half of his mass has been exhausted of hydrogen. This process takes nearly a billion years. At the end of this period of time, Hercules is shining one hundred to one thousand times as brightly as he did when on the main sequence and his evolution has become very rapid.

At this point, the temperature in the degenerate gas at Hercules' center rises sufficiently so that a new set of thermonuclear reactions can start there. These are helium burning reactions which convert helium into carbon, oxygen, and neon when the temperature exceeds one hundred million degrees. The instability in the degenerate gas now causes Hercules' structure to undergo another drastic revision. The core of the star expands and the envelope shrinks. He shines a little less brightly than at the peak of his efforts as a red giant star, but still very much more brightly than as a main sequence star.

Hercules is now close to the end of his life. There are several evolutionary paths which he may take, depending upon how rapidly he rotates and upon the details of his chemical composition. All these paths converge on the same basic end result: Hercules will finally become a white dwarf star.

The average white dwarf star has a mass of only about 0.6 times that of the sun. It is evident that Hercules must cast off some of his bulk into space before he can reach this end. There are three general methods by which this can happen.

Hercules is likely to lose some mass as a red giant star. The surfaces of most if not all red giant stars seem to be in a state of continuous violent agitation produced by very strong magnetic fields. This activity may sometimes eject clouds of gas into space. One red supergiant star is known which is casting off matter at the rate of one solar mass every thirty million years! Continuous ejection may continue through all later stages of evolution and may occur even in the white dwarf stars themselves.

After helium thermonuclear reactions start, the nuclear reactions which take place in Hercules' interior become quite complicated, and his possible evolutionary paths are not yet known in detail. There are some mechanisms which can produce large numbers of neutrons in the interior which will synthesize heavy elements. The helium reactions themselves can convert large portions of the interior of the star into carbon, nitrogen, oxygen, or neon.

Stars at this stage of evolution often develop internal instabilities which cause violent explosions. The nature of these instabilities is not yet known. In the course of an explosion, perhaps a few tenths of a per cent of

the outer mass will be blown off into space. The star is then called a nova. Many novas are known which undergo periodic explosions, with the average interval between explosions a major part of a century. It may well be that all novas are recurrent. In the course of many nova explosions, a substantial portion of a solar mass can be ejected into space.

If a star does not lose mass rapidly in one of these ways, then the central temperature will become higher and higher as the star attempts to maintain its high rate of energy generation. Nuclear reactions become very complicated as elements such as carbon and oxygen react among themselves and even as the radiation at the center becomes energetic enough to disrupt some nuclei. These conditions lead to a gigantic instability followed by a gigantic explosion which blows away a major portion of the star into space. We call this a supernova explosion. The remnant left behind after the explosion is a white dwarf star.

Hercules loses mass quite quickly after passing out of the red giant phase. He becomes a white dwarf star via one of these evolutionary paths in a time of about one hundred million years. He has then cast away almost all his remaining hydrogen. His central density is a million or more times that of water. He may have consumed most of his helium. Almost all of his mass forms a degenerate gas which supports indefinitely the weight of his outer layers. He can no longer generate energy by contraction. He no longer has nuclear energy sources. He is effectively a dead star.

The only reason he is visible at all is that he still has a large store of internal heat, which is gradually radiated away into space. After a very long time even this will be gone, and we should then call him a black dwarf star. But that takes an even longer time than the age of our galaxy, and no white dwarf star has had a long enough time to become a black dwarf.

Stars considerably more massive than Hercules go through these evolutionary stages much more rapidly. Their biographies have not yet been studied in detail, and it is quite likely that some surprising forms of behavior will be discovered when such studies are made.

Stars less massive than Hercules generate energy more slowly, and they lie on the main sequence for times which are longer than the age of our galaxy. Hence none of these stars have yet gone into the red giant stage.

Our sun is gradually warming up, and after about another two billion years or so, the rate of warming will become very marked. The center of the sun now contains about thirty per cent hydrogen by weight, but it will then be exhausted. The sun will gradually develop into a red giant star. Mercury and Venus, and perhaps the Earth and Mars as well, will be swallowed up by the expanding envelope.

Studies of the characteristics of various classes of stars show that those stars formed in our galaxy longest ago are composed of nearly pure hydrogen. Stars formed later contain increasing amounts of heavy elements. In the most recently formed stars, all elements heavier than helium form about four per cent of the star by weight.

We have seen that stars are continuously formed out of the interstellar medium. We have also seen that the more massive stars evolve very rapidly and eject major fractions of their mass back into the interstellar medium. Much of this material has been enriched in heavier elements by nuclear reactions while it formed part of the more massive stars.

Studies of the details of nuclear reactions in stellar interiors have shown that these reactions tend to form different nuclei in the relative proportions that are actually found in the earth, in meteorites, and in the sun and stars. On this account, it now seems very likely that all of the elements out of which the Earth is formed were made in the stars during the early life of our galaxy.

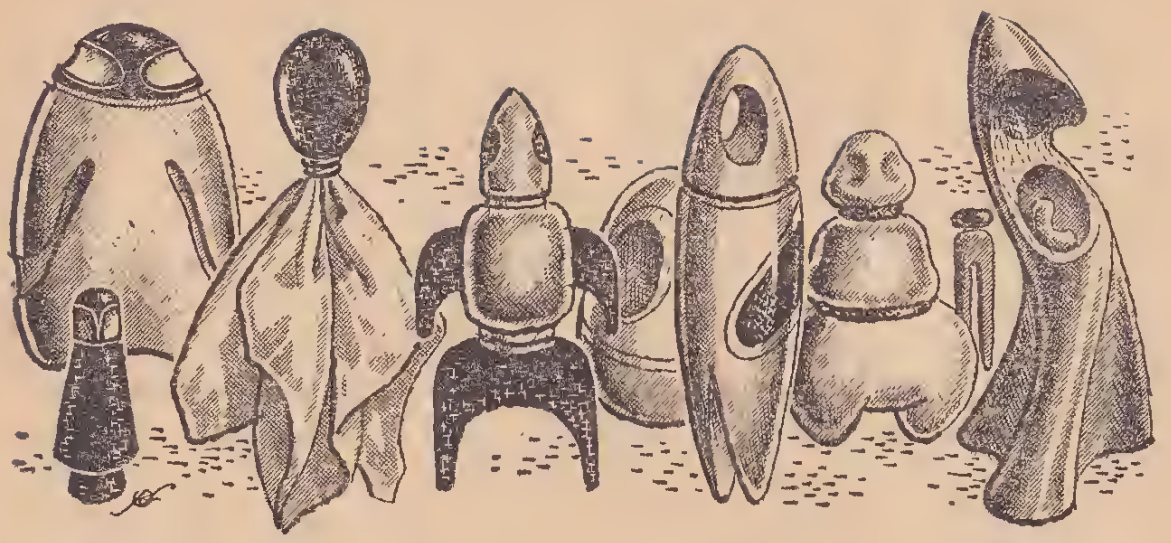
This new concept has far-reaching consequences in any consideration of the types of planetary systems we are likely to have in our galaxy. The galaxy appears to have condensed out of an almost spherical mass of nearly, if not completely, pure hydrogen. The first stars to condense have this nearly spherical distribution. They could not be formed with earthlike planets, although some large bodies of hydrogen gas, equal in mass to that of Jupiter or even greater may have been formed. Later stellar systems intended to form with an increasing degree of concentration towards the central plane of the galaxy. Even when the instellar medium was enriched to about one per cent by weight of elements heavier than helium, earthlike planets would be fairly rare in forming because of the large dilution of nonvolatile elements. The situation will have eased considerably by the time our sun was formed, since it has two per cent by weight of heavier elements. More recent stars should find it even easier to form planets.

This may possibly account for the apparent fact that the earth is not yet overrun with extraterrestrial visitors, since our sun appears to be among the oldest stars which could form planets easily. There are probably relatively few older intelligent races in the galaxy, and very many planets which will develop intelligent life in the next billion years or so.

Another interesting conclusion which may be drawn is that intelligent races are much more likely to develop in spiral galaxies than in the much smaller elliptical galaxies. Gas ejected from stars is much more likely to escape entirely from these smaller galaxies, and hence they will not easily develop interstellar media enriched in heavier elements.

THE END

BASIC



AGREEMENT

BY AVIS PABEL

The essence of communication is simply that of establishing mutually agreed understandings. Sometimes attitudes can be more basic than objects . . .

Illustrated by Freas

IT WASN'T a nightmare. She had had nightmares before and she knew what they were like. All you had to do was turn on the light, and if there was any nightmare left over, it would go away. But she had turned on the light, and it hadn't gone away. She closed her eyes tightly while she counted to twenty, then opened them. It was still there.

Out of the corner of her eye, she watched it. It didn't move, just stood there; and her fear built up higher and higher, until she could bear it no longer. Eyes closed as tightly as she could close them, she screamed.

Presently a voice came: "What is it, Marjorie?" The voice was tired, and more than tired, sarcastic.

"In the corner," she whispered without opening her eyes, "by the dresser."

"There's nothing in the corner by the dresser, Marjorie. Open your eyes." Then: "OPEN YOUR EYES, MARJORIE." When her father spoke to her in that tone, she had no choice but to obey. She looked to where he was pointing. The thing was gone. She breathed a sobbing little sigh of relief.

"Good night," said her father with that same slightly exaggerated weariness in his voice. The door closed behind him before she could say anything.

Fearfully, she watched the corner by the dresser until she fell asleep, but the thing did not come back.

It came back the next night.

She had just finished her bath and brushing her teeth and had squirmed into the warm, yellow flannel nightgown. She sat down on the edge of the bed, leaning over to turn the lights out—and there it was, standing there, looking at her.

At least she thought it was looking at her. It was so hard to see just where the eyes were—or indeed, if it had any eyes.

She had read somewhere that prayer frightened demons away, so she began to pray. But when she opened her eyes again, it was still there. She tried hard, she honestly did, but the scream came bubbling up to her lips before she could stop it.

"MARJORIE!" Her father's voice was very angry this time. The door slammed open and he stood facing her, his eyes fairly snapping with annoyance.

Her eyes darted to the corner. It was empty.

"But it was there," she babbled. "It was, really it was there. Right in the corner—"

"Exactly what did you see?" he asked. He was trying hard to control his temper. Marjorie's mother, standing in the doorway behind him, looked on a little fearfully.

"I don't know," said Marjorie in a very low voice, staring at the carpet a few inches in front of him.

"You don't know. Very well. What did it look like, this you-don't-know-what?"

"It was . . . green, sort of, with arms all over it, only they weren't arms exactly, they were more like snakes. And it had lots of eyes, at least I think they were eyes, only I couldn't tell—" she broke off wretchedly, aware of her father's disgust.

"That's enough. Grace," he said, turning to his wife, "has this child been seeing horror movies again?"

"Not that I know of, Harry," replied Mrs. Barlow. Her voice was a little worried, yet obviously tired of it all, too. "She hasn't seen any movies at all that I know about for the last two months."

"Listen here, young lady," he said, turning back to his daughter, "we're going to get this thing settled once and for all. Now what did I tell you to do when you have nightmares?"

"Turn on the lights, and they'd go away. But—"

"Exactly. That's all you have to do. Just turn on the light. Now will you please do it after this, and stop all this nonsense?"

"But I didn't turn out the light tonight. I just came in from the bathroom, and the light was still on, and there it was—"

"Then turn off the light!" shouted Mr. Barlow, his patience at an end. "Listen to me: if there's one more scene like this, I'm personally going to spank the pants off you."

"But, Harry—"

"Don't interfere, Grace. There's been altogether too much of this kind of thing lately. She just does it to get attention, and I'm not going to put up with any more of it. Jill didn't act like this when she had nightmares."

"Jill never had nightmares, dear. She was always a completely fearless child." Mrs. Barlow sighed a little and went away. Marjorie flushed.

Harry Barlow turned back to his daughter. "Do you understand me, Marjorie? No more screaming in the middle of the night." Marjorie's lower lip started to tremble again. "And no more whining, either. I'm sick of it." He stopped, looking at her, and he sighed. "Look, honey," he went on in a gentler voice, "I don't want to be hard on you, but this has got to stop. Your mother and I work hard all day, and we can't be wakened in the middle of the night all the time just because you imagine you saw something."

Marjorie didn't mention the fact that eight fifteen could scarcely be called the middle of the night, by any standard. She said nothing.

"Good night," said Mr. Barlow firmly, and leaned forward to kiss her bangs. At the sound of the door, closing behind him, Marjorie dived sobbing under the blankets and cried herself to sleep.

It was there again the following night when she came in from her bath. Biting her lips to keep from screaming, she crept into bed and pulled the covers over her head. An hour later, still shaking with fright, she fell asleep.

And it was there the night after that, and the night after that— After a while, Marjorie paid practically no attention to it. The horror of its form still caused a shudder down her spine every time she looked at it directly, but after a few weeks, she had trained herself not to look at that corner of the room at all in the evenings. If it ever moved or tried to touch her, Marjorie thought she would be frightened, but beyond a slight wavering motion in its arm tentacles, it never did, and Marjorie had other things to worry about.

Arithmetic, for one thing. She hadn't got anything better than a "fair" in arithmetic for a long time. Too many fairy tales when she should be doing her homework, the teacher told her parents when they came in for the annual conference. Her father sighed in annoyance and said, "Jill never failed arithmetic in

her life. She was a whiz at math." As usual when Jill was mentioned, Marjorie said nothing. Her father and mother, she had discovered, didn't like her to talk about Jill.

But they could talk about her, Marjorie thought rebelliously. They could talk about her all day long. Jill never did this and Jill was a whiz at that, and Jill this and Jill that until you would have thought there wasn't anyone in the world as good as Jill. She had said as much once, and she would never say anything like that again as long as she lived. The spanking she had received, the cold looks for days afterwards—these were things that would live in her memory until the day she died. "Jill died for you, you ungrateful little monster," her father stormed. "Yes, she died saving your miserable life, and don't you ever forget that!"

But tonight was especially bad. When Marjorie came into her room, her eyes were red with crying. "Why don't you ever bring home any little friends? Jill always used to. She was such a popular little thing. Everyone liked Jill." Her mother's tone had been plaintive, resigned.

In her bath, Marjorie had cried bitterly, and she was not through yet. Flinging herself on the bed she seemed to hear her mother say: "Jill never threw herself at furniture the way you do, Marjorie. Can't you learn to be a little more graceful?"—she wept again, but silently. She always wept silently, for fear of being heard. "Jill never cried. She was always so happy, so full of life."

"But I'm not Jill," she cried softly. "I'm me . . . and they don't want me. I'm . . . so lonely." It was the first time she had ever said it out loud, and somehow it seemed to make it all the more real.

"Want to see my doll?" The voice came from THAT corner, and Marjorie sat bolt upright in terror. The thing had advanced a few steps toward her, and one of its snakelike arms was extended. Hypnotized, Marjorie stared at the thing that dangled from it. It shook a little, making it hard to see, but after a moment, Marjorie realized that it was a small replica of the thing that held it. The sense of what the singsong voice had said got through to her, and she wiped automatically at her nose with the back of her hand. The thing wavered, trembled a little, and suddenly something else became clear to the little girl. It was afraid, too.

The arm moved, then dropped. "I'm lonesome, too," it began falteringly.

Marjorie gulped back a last sob, and said nothing.

"And I'm real good at arithmetic." This time, the strange voice broke a little, pleading almost—

Marjorie smiled suddenly, and it was like the sun coming out from behind a thundercloud on a hitherto gray day.

Pointing to the tentacled doll, she whispered, "What's her name?"

THE END

WE...

Second of Two Parts. *There is no greater sea than the sea of space—nor any darker. But these men had found and been shipwrecked on the darkest of all the planetary islands of space!*

Illustrated by van Dongen

. . . HAVE FED OUR SEA

BY

POUL ANDERSON

SYNOPSIS

The laws of relativistic physics showed just one way to travel faster than light and thus to colonize among the stars. Gravitational forces have no velocity; a signal formed by modulating such forces—through the pulsation of matter-energy between quantum and particle states—would be detected "instantly" by a tuned receiver anywhere else, though the inverse-square law must be evaded by use of relay stations and a focusing effect. Such a signal could be used to send information, and even material objects, across light-years. An atom-by-atom scanning process destroyed the man or the cargo being transmitted but, simultaneously, recreated them in the distant receiver, building up atoms and molecules from the matter bank at that end. The complexity of the signals had so far made it technically impossible to record them, except for single isotopes—so, while pure elements could be manufactured in any quantity, molecular structures could only be transmitted, not duplicated. Considerations of energy and apparatus made the transmission too expensive for anything less than interstellar distances.

Spaceships went out, accelerating to half the speed of light. Spacemen stood turns on them, going home via mattercaster at the end of each month-long watch, until at last a ship reached her target star. Thereafter gravitic transceivers would be built on some airless satellite; men, ships, and materials sent through in quantity; and habitable planets settled. For fear of extraterrestrial disease, each new colony was submitted to a thirty-year quarantine: anyone who went there would not return earlier. Even then he would need special permission; for a restless, overcrowded Earth, whose government was little more than a garrison, did not wish the colonies to acquire any political influence.

The oldest spaceship still in use was the Southern Cross. *For more than two hundred years she had been plunging toward Alpha Crucis, a giant triple star at which the scientists wanted a close look; by now she had gone farther from Sol than any other vessel. But lately her automatic astronomical instruments had revealed a black star not very much off her path—a truly dead sun, totally burned out. This was still more interesting, so the authorities finally agreed that*

the Cross *should decelerate toward it instead.*

Terangi Maclaren of New Zealand had pushed that decision through. He was of technic birth, a hereditary aristocrat, a playboy type but, more or less incidentally, an astrophysicist of some gifts. As the Cross *neared her goal, he arranged for a crew to help him make the initial studies at the black star.*

His scientific assistant was David Ryerson, a young commoner newly graduated as a gravitics specialist. He was also newly wedded, his wife Tamara being an Australian of Oceanic race, and they were planning to emigrate to the newly opened colony planet Rama, in the Washington 5584 system. Ryerson had no desire to accept Maclaren's offer of a berth, but his father Magnus browbeat him into it.

Magnus Ryerson had been a spaceman, and wished his only surviving son to be; old and embittered, he lived alone on an island in the Outer Hebrides, brooding on the days when his own people, Western man, had dominated the Earth. Now war and the rise of other regions had left them an impoverished provincial fragment, their very languages dying.

Despite his father's hostility to her, David Ryerson was forced by propriety to leave Tamara on the island. They would go to Rama when he returned, in a month or two.

The expedition's pilot would be Seiichi Nakamura of Sarai, the Earth-sized satellite of a giant planet in the Capellan System. Nakamura had come there from Earth as a boy and always wistfully remembered Kyoto, which he could not visit again as a colonial. A meteorite had orphaned him, and later space had also killed his brother. Since then Nakamura must often fight against a horror of it. Nevertheless he had become a highly successful spaceship pilot.

The Astronautical Guild assigned Chang Sverdlov to be the engineer. He lived on Krasna in the Tau Ceti System, and was quite content to remain there. Fiercely resentful of Earth's political and economic exploitation of his planet, he was a secret member of the revolutionary Fellowship of Liberation. He had no interest in the Cross *expedition, and wondered if he could stand being in the same ship with Earthlings.*

All four men transmitted from their respective home systems. The Cross *had already been brought close to the dead star. Maclaren wanted to establish an orbit some seven hundred fifty thousand kilometers out, and Nakamura, as pilot, insisted that in that case it was wisest to get there immediately. Thus there was little time to study conditions as the ship decelerated inward; but since this sun must be the remnant of a supernova, no danger was anticipated.*

The ship backed toward her goal on a twin jet of protons and antiprotons —negatrons—formed from disintegrated mercury atoms and accelerated in long linac tubes outside the hull.

Suddenly, a million kilometers out, this intensely hot blast began to strike

the outermost accelerator rings. Since the linac was built into the metal web which helped transmit and receive gravitic signals, the latter was also damaged. Sverdlov wanted to cut blast at once, repair the web, and transmit back home, letting the ship crash on the star. Nakamura insisted that if they did not establish an orbit, they would crash before the web could be fixed. He used his authority to overrule the engineer. Hysterical with fear and rage, Sverdlov charged forward to seize control. Maclaren stopped him with some adroit dirty-fighting tactics.

Nakamura, suppressing his own panic, established an eccentric orbit before the inward-eating fire quite destroyed his accelerators. However, half the linac—worse, more than half the mattercaster web—was melted or vaporized by that time.

Maclaren showed that the trouble had been caused by the star's unexpectedly intense magnetism. Its rapid rotation gave it a field of such unprecedented strength that even this far out, the ion blast was deflected into the accelerator system. The question of who, if anyone, to blame for overlooking this possibility, was one they dared not discuss.

By using spare parts, bar metal, and remelted scrap, Sverdlov thought it would be possible to reconstruct the linacs, with an antimagnetic circuit added. Ryerson said that a 'caster web could be cobbled together in the same fashion, except that there was not enough germanium aboard to replace the super-transistors involved. Even if this could be found somewhere, the new transceiver must be tuned by sheer guesswork until a station on some moon or aboard some other spaceship was contacted. Meanwhile, there were only limited supplies; normally food would have been transmitted from home, recreated out of waste in the matter bank, with every change of watch. It was an open question whether the task could be accomplished before the crew ate its emergency rations and starved to death. Sverdlov flared up at Ryerson. The young man surprised himself by responding so vigorously that Sverdlov shut up. They got to work.

Maclaren and Nakamura had jobs inboard, rebuilding parts. After some time had passed, Maclaren found the pilot struggling against terror. Nakamura told of the experiences which had scarred him. Maclaren made some equally intimate admissions of his own fear, which had a different cause—the hollowness of a life without real purpose or even real friends—but he made them cold-bloodedly, to help Nakamura, the only man able to pilot the ship. They talked for a while of the fact that no planet with natives comparable to man had yet been found, and of what that could mean. Finally, somewhat calmed, Nakamura left.

Sverdlov admitted to MacLaren that he had been eavesdropping, and begged MacLaren to keep up at least a pretense of cool indifference; for they could not hope to survive without a leader, and no one else was able to lead.

PART 2

XI

NAKAMURA noted in the log, which he had religiously maintained, the precise moment when the *Cross* blasted from the dead star. The others had not even tried to keep track of days. There were none out here. There was not even time, in any meaningful sense of the word—only existence, with an unreal impression of sunlight and leaves and women before existence began, like an inverted prenatal memory.

The initial minutes of blast were no more veritable. They took their posts and stared without any sense of victory at their instruments. Nakamura in the control turret, Maclaren on the observation deck feeding him data, Sverdlov and Ryerson watchful in the engine room, felt themselves merely doing another task in an infinite succession.

Sverdlov was the first who broke from his cold womb and knew himself alive. After an hour of poring over his dials and viewscreens, through eyes bulged by two gravities, he ran a hand across the bristles on his jaw. "Holy fecal matter," he whispered, "the canine-descended thing is hanging together."

And perhaps only Ryerson, who had worked outside with him for weeks of hours, could understand.

The lattice jutting from the sphere had a crude, unfinished look. And indeed little had been done toward restoring the transceiver web; time enough for that while they hunted a planet. Sverdlov had simply installed a framework to support his re-fashioned accelerator rings, antimagnetic shielding circuits, and incidental wires, tubes, grids, capacitors, transformers . . . He had tested with a milliampere of ion current, cursed, readjusted, tested again, nodded, asked for a full amp, made obscene comments, readjusted, retested, and wondered if he could have done it without Ryerson. It was not so much that he needed the extra hands, but the boy had been impossibly patient. When Sverdlov could take no more electronic misbehavior, and went back into the ship and got a sledge and pounded at an iron bar for lack of human skulls to break, Ryerson had stayed outside trying a fresh hookup.

Once, when they were alone among galaxies, Sverdlov asked him about it. "Aren't you human, kid? Don't you ever want to throw a rheostat across the room?"

Ryerson's tone came gnatlike in his earphones, almost lost in an endless crackling of cosmic noise. "It doesn't do any good. My father taught me that much. We sailed a lot at home."

"So?"

"The sea never forgives you."

Sverdlov glanced at the other, couldn't find him in the tricky patching of highlight and blackness, and suddenly confronted Polaris. It was like being stabbed. How many men, he thought with a gasp, had followed the icy North Star to their weird?

"Of course," Ryerson admitted humbly, "it's not so easy to get along with people."

And the lattice grew. And finally it tested sound, and Sverdlov told Nakamura they could depart.

The engine which had accelerated the *Cross* to half light speed could not lift her straight away from this sun. Nor could her men have endured a couple of hundred gravities, even for a short time. She moved out at two gees, her gyros holding the blast toward the mass she was escaping, so that her elliptical orbit became a spiral. It would take hours to reach a point where the gravitational field had dropped so far that a hyperbolic path would be practicable.

Sverdlov crouched in his harness, glaring at screens and indicators. That cinder wasn't going to let them escape this easily! He had stared too long at its ashen face to imagine that. There would be some new trick, and he would have to be ready. God, he was thirsty! The ship did have a water-regenerating unit, merely because astronautical regulations at the time she was built insisted on it. Odd, owing your life to some bureaucrat two hundred years dust on his own filing cabinets. But the regenerator was inadequate and hadn't been used in all that time. No need for it: waste material went into the matter bank, and was reborn as water or food or anything else, according to a signal sent from the Lunar station with every change of watch.

But there were no more signals coming to the *Cross*. Food, once eaten, was gone for good. Recycled water was little more than enough to maintain life. *Fire and thunder!* thought Sverdlov, *I can smell myself two kilometers away. I might not sell out the Fellowship for a bottle of beer, but the Protector had better not offer me a case.*

A soft *brroom-brroom-brroom* pervaded his awareness, the engine talked to itself. Too loud, somehow. The instruments read O.K., but Sverdlov did not think an engine with a good destiny would make so much noise. He glanced back at the viewscreens. The black sun was scarcely visible. It couldn't be seen at all unless you knew just where to look. The haywired ugliness of the ion drive made a cage for stars. The faintest blue glow wavered down the rings. Shouldn't be, of course. Inefficiency. St. Elmo's fire danced near the after end of the assembly. "Engine room to pilot. How are we making out?"

"Satisfactory." Nakamura's voice sounded thin. It must be a strain, yes, he was doing a hundred things manually for which the ship lacked robots. But who could have anticipated—?

Sverdlov narrowed his eyes. "Take a look at the tail of this rig, Dave," he said. "The rear negatron ring. See anything?"

"Well—" The boy's eyes, dark-rimmed and bloodshot, went heavily after Sverdlov's pointing finger. "Electrostatic discharge, that blue light—"

"See anything else?" Sverdlov glanced uneasily at the megameters. He did not have a steady current going down the accelerators, it fluctuated continually by several per cent. But was the needle for the negatron side creeping ever so slowly downward?

"No. No, I can't."

"Should'a put a thermocouple in every ring. Might be a very weak deflection of ions, chewing at the endmost till all at once its focusing goes blooey and we're in trouble."

"But we tested every single— And the star's magnetic field is attenuating with every centimeter we advance."

"Vibration, my cub-shaped friend. It'd be easy to shake one of those jury-rigged magnetic coils just enough out of alignment to— *Hold it!*"

The terminal starboard coil glowed red. Blue electric fire squirted forth and ran up the lattice. The negative megameter dropped ten points and Sverdlov felt a little surge as the ship wallowed to one side from an unbalanced thrust.

"Engine room stopping blast!" he roared. His hand had already gone crashing onto the main lever.

The noise whined away to a mumble. He felt himself pitched off a cliff as high as eternity.

"What's the trouble?" barked Maclaren's voice.

Sverdlov relieved himself of a few unrepeatable remarks. "Something's gone sour out there. The last negatron accelerator began to glow and the current to drop. Didn't you feel us yaw?"

"Oh, Lord, have mercy," groaned Ryerson. He looked physically sick. "Not again."

"Ah, it needn't be so bad," said Sverdlov. "Me, I'm surprised the mucking thing held together this long. You can't do much with baling wire and spit, you know." Inwardly, he struggled with a wish to beat somebody's face.

"I presume we are in a stable orbit," said Nakamura. "But I would feel a good deal easier if the repair can be made soon. Do you want any help?"

"No. Dave and I can handle it. Stand by to give us a test blast."

Sverdlov and Ryerson got into their spacesuits. "I swear this smells fouler every day," said the Krasnan. "I didn't believe I could be such a filth generator." He slapped down his helmet and added into the radio: "So much for man the glorious star-conqueror."

"No," said Ryerson.

"What?"

"The stinks are only the body. That isn't important. What counts is the soul inside."

Sverdlov cocked his bullet head and stared at the other armored shape. "Do you actually believe that guff?"

"I'm sorry, I didn't mean to preach or—"

"Never mind. I don't feel like arguing either." Sverdlov laughed roughly. "I'll give you just one thing to mull over, though. If the body's

such a valueless piece of pork, and we'll all meet each other in the sweet bye and bye, and so on, why're you busting every gut you own to get back to your wife?"

He heard an outraged breath in his earphones. For a moment he felt he had failed somehow. There was no room here for quarrels. *Ah, shaft it,* he told himself. *If an Earthling don't like to listen to a colonial, he can jing-bangle well stay out of space.*

They gathered tools and instruments in a silence that smoldered. When they left the air lock, they had the usual trouble in seeing. Then their pupils expanded and their minds switched over to the alien gestalt. A raw blaze leaped forth and struck them.

Feeling his way aft along the lattice, Sverdlov sensed his anger bleed away. The boy was right—it did no good to curse dead matter. Save your rage for those who needed it, tyrants and knaves and their sycophants. And you might even wonder—it was horrible to think—if they were worth it either. He stood with ten thousand bitter suns around him; but none were Sol or Tau Ceti. O Polaris, death's lodestar, are we as little as all that?

He reached the end of the framework, clipped his life line on, and squirted a light-diffusing fog at the ring. Not too close, he didn't want it to interfere with his ion stream, but it gave him three-dimensional illumination. He let his body float out behind while he pulled himself squinting-close to the accelerator.

"Hm-m-m, yes, it's been pitted," he said. "Naturally it would be the negatron side which went wrong. Protons do a lot less harm, striking terrene matter. Hand me that counter, will you?"

Ryerson, wordless and faceless, gave him the instrument. Sverdlov checked for radioactivity. "Not enough to matter," he decided. "We won't have to replace this ring, we stopped the process in time. By readjusting the magnetic coils we can compensate for the change in the electric focusing field caused by its gnawed-up shape. I hope."

Ryerson said nothing. *Good grief,* thought Sverdlov, *did I offend him that much?* Hitherto they had talked a little when working outside, not real conversation but a trivial remark now and then, a grunt for response . . . just enough to drown out the hissing of the stars.

"Hello, pilot. Give me a microamp. One second duration."

Sverdlov moved out of the way. Even a millionth of an ampere blast should be avoided, if it was an antiproton current.

Electric sparks crawled like ivy over the bones of the accelerator. Sverdlov, studying the instruments he had planted along the ion path, nodded. "What's the potentiometer say, Dave?" he asked. "If it's saying anything fit to print, I mean."

"Standard," snapped Ryerson.

Maybe I should apologize, thought Sverdlov. And then, in a geyser: *Judas, no! If he's so thin-skinned as all that, he can rot before I do.*

The stars swarmed just out of reach. Sometimes changes in the eyeball made them seem to move. Like flies. A million burning flies. Sverdlov swatted, unthinkingly, and snarled to himself.

After a while it occurred to him that Ryerson's nerves must also be rubbed pretty thin. You shouldn't expect the kid to act absolutely sensibly. *I lost my own head at the very start of this affair,* thought Sverdlov. The memory thickened his temples with blood. He began unbolting the Number One magnetic coil as if it were an enemy he must destroy as savagely as possible.

"O.K., gimme another microamp one-second test."

"Try shifting Number Two a few centimeters forward," said Ryerson.

"You crazy?" snorted Sverdlov. *Yes, I suppose we're all a bit crazy by now.* "Look, if the deflected stream strikes here, you'll want to bend it down like so and—"

"Never mind." Ryerson could not be seen to move, in the bulk of his armor, but Sverdlov imagined him turning away with a contemptuous shrug. It took several minutes of tinkering for the Krasnan to realize that the Earthling had visualized the interplay of forces correctly.

He swallowed. "You were right," he emitted.

"Well, let's get it reassembled," said Ryerson coldly.

Very good, Earth snob, sir. Sverdlov attacked the coils for several more minutes. "Test blast." Not quite. Try another setting. "Test blast. Repeat." That seemed to be it. "Give me a milliamp this time . . . A full amp . . . hm-m-m." The current had flowed too short a time to heat the ring, but needles wavered wildly.

"We're still getting some deflection," said Sverdlov. "Matter of velocity distribution. A certain small percentage of the particles have abnormal velocities and—" He realized he was crouched under Ryerson's hidden eyes babbling the obvious. "I'll try sliding this one a wee bit more aside. Gimme that vernier wrench— So. One amp test blast, please."

There was no further response from the instruments. Ryerson let out a whistling sigh. "We seem to have done it," he said.

We? thought Sverdlov. *Well, you handed me a few tools!*

Aloud: "We won't know for sure till full thrust is applied."

"Of course." Ryerson spoke hesitantly. Sverdlov recognized the tone, it was trying to be warm. Ryerson was over his fit of temper.

Well, I'm not!

"There isn't anything to be done about that except to try it and see, is there?" went on the Earthling.

"And if we still get significant deflection, drag on our suits and crawl back here—maybe a dozen times? No!"

"Why, that was how we did it before."

"I'm getting awfully hungry," said Sverdlov. Suddenly it flared out of him. "I'm sick of it! I'm sick of

being cooped up in my own stink, and yours, I'm sick of the same stupid faces and the same stupid remarks, yes, the same stars even! I've had enough! Get on back inside. I'll stay here and watch under acceleration. If anything goes wrong, I'll be right on the spot to fix it."

"But—"

Nakamura's voice crackled above the mutter of stars. "What are you thinking of, Engineer Sverdlov? Two gravities would pull you off the ship! And we're not maneuverable enough to rescue you."

"This life line is tested for two thousand kilos," said the Krasnan. "It's standard procedure to make direct high-acceleration checks on the blast."

"By automatic instruments."

"Which we haven't got. Do you *know* the system is fully adjusted? Are you so sure there isn't some small cumulative effect, so the thing will quit on you one day when you need it the most?"

Maclaren's tone joined in, dry and somehow remote: "This is a curious time to think about that."

"I am the engineer," said Sverdlov stiffly. "Read the ship's articles again."

"Well," said Nakamura. "Well, but—"

"It would save time," said Ryerson. "Maybe even a few days' worth of time, if the coils really are badly maladjusted."

"Thanks, Dave," said Sverdlov clumsily.

"Well," said Nakamura, "you have the authority, of course. But I ask you again—"

"All I ask of *you* is two gravities' worth of oof for a few seconds," interrupted Sverdlov. "When I'm satisfied this ring will function properly, so we won't have to be forever making stops like this, I'll come inside."

He hooked his legs about the framework and began resetting the instruments clamped onto it. "Get on back, Dave," he said.

"Why . . . I thought I would—"

"No need to."

"But there is! You can't read every dial simultaneously, and if there's work to be done you'll need help."

"I'll call you if I want you. Give me your tool belt." Sverdlov took it from reluctant hands and buckled it around himself. "There is a certain amount of hazard involved, Dave. If I should be unlucky, you're the closest approximation to an engineer the ship will have. She can't spare both of us."

"But why take any risk at all?"

"Because I'm sick of being here! Because I've got to fight back at that black coal or start howling! Now get inside!"

As he watched the other blocky shape depart him, Sverdlov thought: *I am actually not being very rational, am I now? But who could expect it, a hundred light-years from the sun?*

As he made ready, he puzzled over what had driven him. There was the need to wrestle something tangible; and surely to balance on this skeleton

of metal, under twice his normal weight, was a challenge. Beyond that, less important really, was the logic of it: the reasons he had given were sound enough as far as they went, and you could starve to death while proceeding at the pace of caution.

And below it all, he thought, was a dark wish he did not understand. Li-Tsung of Krasna would have told him to live at all costs, sacrifice all the others, to save himself for his planet and the Fellowship. But there were limits. You didn't have to accept Dave's Calvinism—though its unmerciful God seemed very near this dead star—to swallow the truth that some things were more important than survival. Than even the survival of a cause.

Maybe I'm trying to find out what those things are, he thought confusedly.

He crawled "up" till his feet were braced on a cross-member, with the terminal accelerator ring by his right ankle but the electroprober dial conveniently near his faceplate. His right hand gripped a vernier wrench, his left drew taut the life line. "Stand by for blast," he said into his radio. "Build up to two gees over a one-minute period, then hold it till I say cut."

Nothing happened for a while except the crawling of the constellations as gyros brought the ship around. Good boy, Seiichi! He'd get some escape distance out of even a test blast. "Stand by," it said in Sverdlov's earphones. And his weight came back to him, until he felt an exultant straining in the muscles of shoulder and arm and leg and belly; until his heart thudded loud enough to drown out the thin crackling talk of the stars.

The hull was above him now, a giant sphere upheld on twin derricks. Down the middle of each derrick guttered a ghostly blue light, and sparks writhed and fountained at junction points. The constellations shone chill through the electric discharge.

Inefficient, thought Sverdlov. *The result of reconstruction without adequate instruments. But it's pretty. Like festival fireworks.* He remembered a pyrotechnic display once, when he was small. His mother had taken him. They sat on a hired catamaran and watched wonder explode softly above the lake.

"Uh," grunted Sverdlov. He narrowed his eyes to peer at the detector dial. There certainly was a significant deflection yet, when whole grams of matter were being thrown out every second. It didn't heat up the ring very much, maybe not enough to notice; but negatrons plowed through terrene electron shells, into terrene nuclei, and atoms were destroyed. Presently there would be crystal deformation, fatigue, ultimate failure. He reported his findings and added with a sense of earned boasting: "I was right. This had to be done."

"I shall halt blast, then. Stand by."

Weightlessness came back. Sverdlov reached out delicately with his wrench, nipped a coil nut, and loosened the bolt. He shifted the coil it-

self backward. "I'll have this fixed in a minute. There! Now give me three gees for about thirty seconds, just to make sure."

"Three? Are you certain you—"

"I am. Fire!"

It came to Sverdlov that this was another way a man might serve his planet: just by being the right kind of man. Maybe a better way than planning the extinction of people who happened to live somewhere else. *Oh, come off it,* he told himself, *next thing you'll be teaching a Humane League kindergarten.*

The force on him climbed, and his muscles rejoiced in it.

At three gees there was no deflection against the ring . . . or was there? He peered closer. His right hand, weighted by the tool it still bore, slipped from the member on which it had been leaning. Sverdlov was thrown off balance. He flung both arms wide, instinctively trying not to fall. His right went between the field coils and into the negatron stream.

Fire spouted.

Nakamura cut the drive. Sverdlov hung free, staring by starlight at his arm. The blast had sliced it across as cleanly as an industrial torch. Blood and water vapor rushed out and froze in a small cloud, pale among the nebulae.

There was no pain. Not yet. But his eardrums popped as pressure fell. "Engine room!" he snapped. A part of him stood aside and marveled at his own mind. What a survival machine, when the need came! "Emergency! Drop total accelerator voltage to one thousand. Give me about ten amps down the tube. Quick!"

He felt no weight, such a blast didn't exert enough push on the hull to move it appreciably. He thrust his arm back into the ion stream. Pain did come now, but in his head, as the eardrums ruptured. One minute more and he would have the bends. The gas of antiprotons roared without noise around the stump of his wrist. Steel melted. Sverdlov prodded with a hacksaw gripped in his left hand, trying to seal the spacesuit arm shut.

He seemed far away from everything. Night ate at his brain. He asked himself once in wonderment: "Was I planning to do this to other men?"

When he thought the sleeve was sealed, he withdrew it. "Cut blast," he whispered. "Come and get me." His airtanks fed him oxygen, pressure climbed again inside the suit. It was good to float at the end of a life line, breathing. Until he began to strangle on his own blood. Then he gave up and accepted the gift of darkness.

XII

Now, about winter solstice, day was a pale glimmer, low in the south among steel-colored clouds. Tamara had been walking since the first light sneaked across the ocean, and already the sun was close to setting. She wondered if space itself could be blacker than this land. At least you saw the stars in space. On Skula you huddled

indoors against the wind, and the sky was a blind whirl of snow.

A few dry flakes gusted as she came down off the moor to the beach. But they carried no warmth with them, there was not going to be a snowfall tonight. The wind streaked in from a thousand kilometers of Atlantic and icebergs. She felt the cold snap its teeth together around her; a hooded cloak was small protection. But she *would* not go back to the house. Not till day had drained from the world and it would be unsafe to remain outdoors.

She said to herself, drearily: "I would stay here even then, except it might harm the child, and the old man would come looking for me. David, help me, I don't know which would be worse!"

There was a twisted pleasure in being so honest with herself. By all the conventions, she should be thinking only of David's unborn baby, herself no more than its vessel. But it was not real to her . . . not yet . . . so far it was only sickness in the mornings and bad dreams at night. The reality was Magnus Ryerson, animallike hairiness and a hoarse grumble at her for not doing the housework his way and incomprehensible readings aloud—his island and his sea and his language lessons!

For a moment her hands clawed together. If she could so destroy Magnus Ryerson!

She fought for decorum. She was a lady. Not a technic, but still a professor's daughter; she could read and write, she had learned to dance and play the flute, pour tea and embroider a dress and converse with learned men so they were not too bored while waiting for her father . . . the arts of graciousness. Her father would call it contrasocial, to hate her husband's father. This was her family now.

But.

Her boots picked a way down the hillside, through snow and heather bushes, until she came out on a beach of stones. The sea came directly in here, smashing at heaped boulders with a violence that shivered through the ground. She saw how the combers exploded where they struck. Spindrift stung her skin. Beyond the rocks was only a gray waste of galloping white-bearded waves, and the wind keening down from the Pole. It rolled and boomed and whistled out there.

She remembered a living greenish blue of southern waters, how they murmured up to the foot of palm trees under infinitely tall skies.

She remembered David saying wryly: "My people were Northerners as far back as we can trace it—Picts, Norse, Scots, sailors and crofters on the Atlantic edge—that must be why so many of them have become spacemen in the last several generations. To get away!"

And then, touching her hair with his lips: "But I've found what all of them were really looking for."

It was hard to imagine that David's warmth and tenderness and laughter had arisen in this tomb of a country. She had always thought of the religion which so troubled him—he first

came to know her through her father, professor and student had sat up many nights under Australian stars while David groped for a God not all iron and hellfire—as an alien stamp, as if the legendary Other Race Out There had once branded him. The obscurity of the sect had aided her: Christians were not uncommon even today, but she had vaguely imagined a Protestant was some kind of Moslem.

Now she saw that Skula's dwellers and Skula's God had come from Skula itself, with winter seas in their veins. David had not been struggling toward normality; he had been reshaping himself into something which—down underneath—Magnus Ryerson thought was not human. Suddenly, almost blindingly, Tamara remembered a few weeks ago, one night when the old man had set her a ballad to translate. "Our folk have sung it for many hundreds of years," he said—and how he had looked at her under his heavy brows.

He hath taken off cross and iron helm,
He hath bound his good horse to a limb,
He hath not spoken Jesu name
Since the Faerie Queen did first kiss him.

Tamara struck a fist into one palm. The wind caught her cloak and peeled it from her, so that it flapped at her shoulders like black wings. She pulled it back around her, shuddering.

The sun was a red sliver on the world's rim. Darkness would come in minutes, so thick you could freeze to death fumbling your way home. Tamara began to walk, quickly, hoping to find a decision. She had not come out today just because the house was unendurable. But her mind had been stiff, as if rusted. She still didn't know what to do.

Or rather, she thought, *I do know, but haven't saved up enough courage.*

When she reached the house, the air was already so murky she could almost not make out whitewashed walls and steep snow-streaked roof. A few yellow gleams of light came through cracks in the shutters. She paused at the door. To go in—! But there was no choice. She twisted the knob and stepped through. The wind and the sea-growl came in with her.

"Close the door," said Magnus. "Close the door, you little fool."

She shut out all but a mumble and whine under the eaves, hung her cloak on a peg and faced around. Magnus Ryerson sat in his worn leather chair with a worn leather-bound book in his hands. As always, as always! How could you tell one day from the next in this den? The radiglobe was turned low, so that he was mostly shadow, with an icicle gleam of eyes and a dirty-white cataract of beard. A peat fire sputtered forlornly, trying to warm a tea kettle on the hob.

Ryerson put the book down on his lap, knocked out his archaic pipe—it had made the air foul in here—and asked roughly: "Where have you

been all day, girl? I was about to go look for you. You could turn an ankle and die of exposure, alone on the ling."

"I didn't," said Tamara. She exchanged her boots for zori and moved toward the kitchen.

"Wait!" said Magnus. "Will you never learn? I want my high tea just at 1630 hours— Now. You must be more careful, lass. You're carrying the last of the Ryersons."

Tamara stopped. There was a downward slant to the ancient brick floor, she felt vaguely how her body braced itself. More nearly she felt how her chilled skin, which had begun to tingle as it warmed, grew numb again.

"Besides David," she said.

"If he is alive. Do you still believe it, after all these weeks?" Magnus began scraping out his pipe. He did not look at her.

"I don't believe he is dead," she answered.

"The Lunar crew couldn't establish grav-beam contact. Even if he is still alive, he'll die of old age before that ship reaches any star where men have an outpost. No, say rather he'll starve!"

"If he could repair whatever went wrong—"

The muffled surf drums outside rolled up to a crescendo. Magnus tightened his mouth. "That is one way to destroy yourself . . . hoping," he said. "You must accept the worst, because there is always more of the worst than the best in this universe."

She glanced at the black book he called a Bible, heavy on one of the crowded shelves. "Do your holy writings claim that?" she asked. Her voice came out as a stranger's croak.

"Aye. So does the second law of thermodynamics." Magnus knocked his pipe against the ashtray. It was an unexpectedly loud noise above the wind.

"And you . . . and you . . . won't even let me put up his picture," she whispered.

"It's in the album, with my other dead sons. I'll not have it on the wall for you to blubber at. Our part is to take what God sends us and still hold ourselves up on both feet."

"Do you know—" Tamara stared at him with a slowly rising sense of horror. "Do you know, I cannot remember just what he looked like?"

She had had some obscure hope of provoking his rage. But the shaggy-sweatered broad shoulders merely lifted, a little shrug. "Aye, that's common enough. You've the words, blond hair and blue eyes and so on, but they make not any real image. Well, you didn't know him so very long, after all."

You are telling me I am a foreigner, she thought. *An interloper who stole what didn't belong to me.*

"There's time to review a little English grammar before tea," said the old man. "You've been terrible with the irregular verbs."

He put his book on the table—she recognized the title, Kipling's poems, whoever Kipling had been—and pointed at a shelf. "Fetch the text and sit down."

Something flared in the girl. She doubled her fists. "No."

"What?" The leather face turned in search of her.

"I am not going to study any more English."

"Not—" Magnus peered as if she were a specimen from another planet. "Don't you feel well?"

She bit off the words, one after another: "I have better ways to spend my time than learning a dead language."

"Dead?" cried the man. She felt his rage lift in the air between them. "The language of fifty million—"

"Fifty million ignorant provincials, on exhausted lands between bombed-out cities," she said. "You can't step outside the British Isles or a few pockets on the North American coast and have it understood. You can't read a single modern author or scientist or . . . or anybody . . . in English— I say it's dead! A walking corpse!"

"Your own husband's language!" he bawled at her, half rising.

"Do you think he ever spoke it to anyone but you, once he'd . . . he'd escaped?" she flung back. "Did you believe . . . if David ever returns from that ship you made him go on . . . and we go to Rama—did you imagine we'd speak the language of a dying race? On a new world?"

She felt the tears as they whipped down her face, she gulped after breath amidst terror. The old man was so hairy, so huge. When he stood up, the single radiglobe and the wan firelight threw his shadow across her and choked a whole corner of the room with it. His head bristled against the ceiling.

"So now your husband's race is dying," he said like a gun. "Why did you marry him, if he was that effete?"

"*He* isn't!" she called out. The walls wobbled around her. "You are! Sitting here in your dreams of the past, when your people ruled Earth—a past we're well out of! David was going where . . . where the future is!"

"I see." Magnus Ryerson turned half away from her. He jammed both fists into his pockets, looked down at the floor and rumbled his words to someone else—not her.

"I know. You're like the others, brought up to hate the West because it was once your master. Your teacher. The white man owned this planet a few centuries ago. Our sins then will follow us for the next thousand years . . . till your people fail in their turn, and the ones you raised up take revenge for the help they got. Well, I'm not going to apologize for my ancestors. I'm proud of them. We were no more vicious than any other men, and we gave . . . even on the deathbed of our civilization, we gave you the stars."

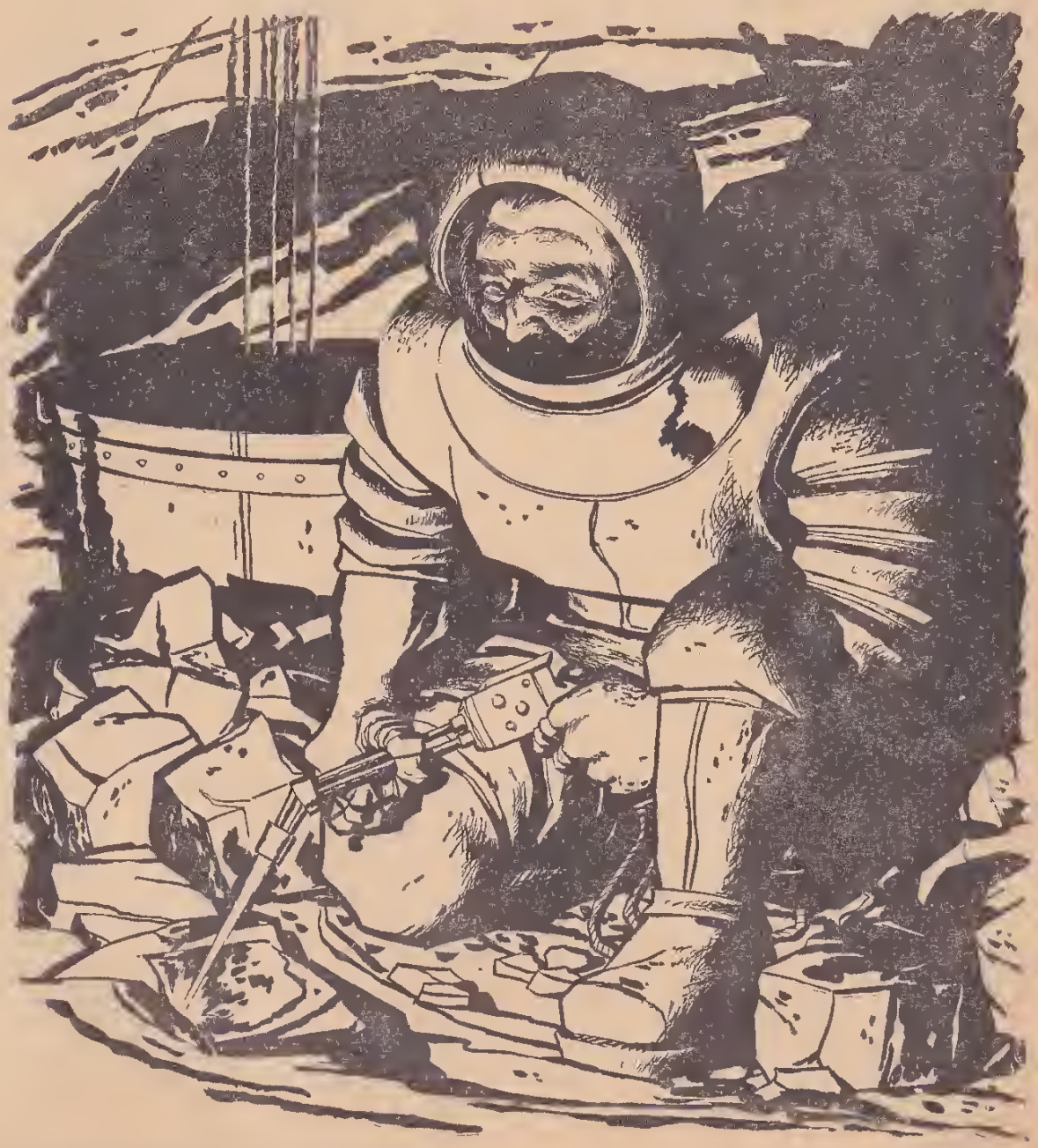
His voice rose until it roared. "And we're not dead yet! Do you think this miserable Protectorate is a society? It isn't! It's not even a decent barbarism. It's a glorified garrision. It's one worshiping the *status quo* and afraid to look futureward. I

went to space because my people once went to sea. I gave my sons to space, and you'll give yours to space, because that's where the next civilization will be! And you'll learn the history and the language of our people—your people—you'll learn what it *means* to be one of us!"

His words rang away into emptiness. For a while only the wind and a few tiny flames had voice. Down on the strand, the sea worried the island like a terrier with a rat.

Tamara said finally: "I already know what it means. It cost me David, but I know."

He faced her again, lowered his head and stared as if at an enemy.



"You murdered him," she said, not loudly. "You sent him to a dead sun to die. Because you—"

"You're overwrought," he broke in with tight-held anger. "I urged him to try just one space expedition. And this one was important. It could have meant a deal to science. He would have been proud afterward, whatever he did for a career, to say, 'I was on the *Cross*.' "

"So he should die for his pride?" she said. "It's as senseless a reason as the real one. But I'll tell you why you really made him go . . . and if you deny you forced him, I'll say you lie! You couldn't stand the idea that one child of yours had broken away—was not going to be wrenched into your image—had penetrated this obscene farce of space exploration, covering distance for its own sake, as if there were some virtue in a large number of kilometers. David was going to live as nature meant him to live, on a living soil, with untanked air to breathe and with mountains to walk on instead of a spinning coffin . . . and his children would too . . . we would have been happy! And that was what you couldn't stand to have happen!"

Magnus grinned without humor. "There's a lot of meaningless noise for a symbolics professor's daughter to make," he said. "To begin at the end, what proof have you we were meant to be happy?"

"What proof have you we were meant to jump across light-years?" she spat. "It's another way of running from yourself—no more. It's not even a practical thing. If the ships only looked for planets to colonize, I could understand. But . . . the *Cross* herself was aimed for three giants! She was diverted to a black clinker! And now David is dead . . . for what? Scientific curiosity? You're not a research scientist, neither was he, and you know it. Wealth? He wasn't being paid more than he could earn on Earth. Glory? Few enough people on Earth care about exploration; not many more on Rama; he, not at all. Adventure? You can have more adventure in an hour's walk through a forest than in a year on a spaceship. I say you murdered your son because you saw him becoming sane!"

"Now that's enough," growled Magnus. He took a step toward her. "I've heard enough out of you. In my own house. And I never did hold with this new-fangled notion of letting a woman yap—"

"Stand back!" she yelled. "I'm not *your* wife!"

He halted. The lines in his face grew suddenly blurred. He raised his artificial hand as if against a blow.

"You're my son's wife," he said, quite gently. "You're a Ryerson too . . . now."

"Not if this is what it means." She had found the resolution she sought. She went to the wall and took her cloak off its peg. "You'll lend me your aircar for a hop to Stornoway, I trust. I will send it back on autopilot and get transport for myself from there."

"But where are you going?" His voice was like a hurt child's.

"I don't know," she snapped. "To some place with a bearable climate. David's salary is payable to me till he's declared dead, and then there will be a pension. When I've waited long enough to be sure he won't come back, I'm going to Rama."

"But, lass . . . propriety—"

"Propriety be damned. I'd rather have David's child, alive."

She slipped her boots back on, took a flashlight from the cupboard, and went out the door. As she opened it, the wind came straight in and hit Magnus across the face.

XIII

"In the land of Chinchanchou,
Where the winds blow tender
From a sea like purple wine
Foaming to defend her,
Lives a princess beautiful
(May the gods amend her!)
Little known for virtue, but
Of most female gender."

As he came around the gyro housing and pulled himself forward to the observation deck, David Ryerson heard the guitar skitter through half a dozen chords and Maclaren's voice come bouncing in its wake. He sighed, pushed the lank yellow hair back out of his eyes, and braced himself.

Maclaren floated in the living section. It was almost an insult to see him somehow clean all over, in a white tunic, when each man was allowed a daily spongeful of water for such purposes. And half rations had only leaned the New Zealander down, put angles in his smooth brown countenance; he didn't have bones jutting up under a stretched skin like Ryerson, or a flushed complexion and recurring toothache like Nakamura. It wasn't fair!

"Oh, hullo, Dave." Maclaren continued tickling his strings, but quietly. "How does the web progress?"

"I'm done."

"Hm-m-m?"

"I just clinched the last bolt and spotwelded the last connection. There's not a thing left except to find that germanium, make the transistors, and adjust the units." Ryerson hooked an arm around a stanchion and drifted free, staring out of sunken eyes toward emptiness. "God help me," he murmured, "what am I going to do now?"

"Wait," said Maclaren. "We can't do much except wait." He regarded the younger man for a while. "Frankly, both Seiichi and I found excuses not to help you, did less out there than we might have, for just that reason. I've been afraid you would finish the job before we found our planet."

Ryerson started. Redness crept into his chalky face. "Why, of all the—" His anger collapsed. "I see. All right."

"These weeks since we escaped have been an unparalleled chance to practice my music," remarked Maclaren. "I've even been composing. Listen.

"In their golden-masted ships
Princes come a-wooing
Over darkling spindrift roads
Where the gales are brewing.
Lusty tales have drawn them thence,
Much to their undoing:
When they seek the lady's hand
She gives them *the—"*

"Will you stop that?" screamed Ryerson.

"As you like," said Maclaren mildly. He put the guitar back into its case. "I'd be glad to teach you," he offered.

"No."

"Care for a game of chess?"

"No."

"I wish to all the hells I'd been more of an intellectual," said Maclaren. "I never was, you know. I was a playboy, even in science. Now . . . I wish I'd brought a few hundred books with me. When I get back, I'm going to read them." His smile faded. "I think I might begin to understand them."

"When we get back?" Ryerson's thin frame doubled in midair as if for a leap. "If we get back, you mean!"

Nakamura entered. He had a sheaf of scribbled papers in one hand. His face was carefully blank. "I have completed the calculations on our latest data," he said.

Ryerson shuddered. "What have you found?" he cried.

"Negative."

"Lord God of Israel," groaned Ryerson. "Negative again."

"That pretty well covers this orbit, then," said Maclaren calmly. "I've got the elements of the next one computed—somewhere." He went out among the instruments.

A muscle in Ryerson's cheek began to jump of itself. He looked at Nakamura for a long time. "Isn't there anything else we can do?" he asked. "The telescopes, the— Do we just have to *sit*?"

"We are circling a dead sun," the pilot reminded him. "There is only feeble starlight to see by. A very powerful instrument might photograph a planet, but not the telescopes we have. Not at any distance greater than we could find them gravitationally. S-s-so."

"We could make a big telescope!" exclaimed Ryerson. "We have glass, and . . . and silver and—"

"I've thought of that." Maclaren's tones drifted back from the observation section. "You're welcome to amuse yourself with it, but we'd starve long before a suitable mirror could be ground with the equipment here."

"But—Maclaren, space is so big! We could hunt for a million years and never find a planet if we can't . . . can't see them!"

"We're not working quite at random." Maclaren reappeared with a punched tape. "Perhaps you've forgotten the principle on which we are searching. We establish ourselves in an orbit about the star, follow it for a while, check our position repeatedly, and compute whether the path has been significantly perturbed.

If it has been, that's due to a planet somewhere, and we can do a Leverrier to find that planet. If not—if we're too far away—we quarter to another arc of the same path and try again. Having exhausted a whole circumference thus, we move outward and try a bigger circle."

"Shut up!" rasped Ryerson. "I know it! I'm not a schoolboy. But we're *guessing!*"

"Not quite," said Maclaren. "You were occupied with the web when I worked out the secondary principle . . . yes, come to think of it, you never did ask me before. Let me explain. You see, by extrapolating from data on known stellar types, I know approximately what this star was like in its palmy days. From this, planetary formation theory gives me the scale of its one-time system. For instance, its planets must have been more or less in the equatorial plane; such quantities as mass, angular momentum, and magnetic field determine the Bode's Law constants; to the extent that all this is known, I can draw an orbital map.

"Well, then the star went supernova. Its closer planets were whiffed into gas. The outermost giants would have survived, though badly damaged. But the semimajor axes of their orbits were so tremendous—theoretically, planets could have formed as much as a light-year from this star—that even a small percentage of error in the data makes my result uncertain by Astronomical Units. Another factor: the explosion filled this space with gas. We're actually inside a nonluminous nebula. That would shorten the orbits of the remaining planets; in the course of millions of years they've spiraled far inward. In one way that helps us: we've an area to search which is not hopelessly huge. But on the other hand, just how long has it been since the accident? What's the density distribution of the nebula now, and what was it back then? I've taken some readings and made some estimates. All very crude, but—" Maclaren shrugged—"what else can we do? The successive orbits we have been trying are, more or less, those I have calculated for the surviving planets as of today. And, of course, intermediate radii to make sure that we will be measurably perturbed no matter where those planets actually are. It's just a matter of getting close enough to one of them."

"If our food lasts," groaned Ryerson. "And we have to eat while we finish the web, too. Don't forget that."

"We're going to have to reorganize our schedules," declared Maclaren thoughtfully. "Hitherto we've found things to keep us occupied. Now we must wait, and not go crazy waiting." He grinned. "I hereby declare the *Southern Cross* dirty limerick contest open and offer a prize of—"

"Yes," said Ryerson. "Great sport. Fun and games, with Chang Sverdlov's frozen corpse listening in!"

Silence clapped down. They heard the air mumble in the ventilators.

"What else can we do with our

poor friend?" asked Nakamura softly. "Send him on a test rocket into the black sun? He deserved better of us. Yes-s-s? Let his own people bury him."

"Bury a copy of him!" shrieked Ryerson. "Of all the senseless—"

"Please," said Nakamura. He tried to smile. "After all . . . it is no trouble, to us, and it will comfort his friends at home, maybe yes? After all, speaking in terms of atoms, we do not even wish to send ourselves back. Only copies." He laughed.

"Will you stop that giggling!"

"Please." Nakamura pushed himself away, lifting astonished hands. "Please, if I have offended you, I am so sorry."

"So sorry! So sorry! Get out of here! Get out, both of you! I've seen more of you than I can stand!"

Nakamura started to leave, still bobbing his head, smiling and hissing in the shaftway. Maclaren launched himself between the other two. He snapped a hand onto either wrist.

"That will do!" They grew suddenly aware, it was shocking, how the eyes burned green in his dark hooked face. His words fell like axes. "Dave, you're a baby, screaming for mother to come change you. Seiichi, you think it's enough to make polite noises at the rest of the world. If you ever want to see sunlight again, you'll both have to mend your ideas." He shook them a little. "Dave, you'll keep yourself clean. Seiichi, you'll dress for dinner and talk with us. Both of you will stop feeling sorry for yourselves and start working to survive. And the next step is to become civilized again. We haven't got the size, or the time, or the force to beat that star: nothing but manhood. Now go off and start practicing how to be men!"

They said nothing, only stared at him for a few moments and then departed in opposite directions. Maclaren found himself gazing stupidly at his guitar case. *I'd better put that away till it's requested,* he thought. *If ever. I didn't stop to think, my own habits might possibly be hard to live with.*

After a long time: *Seems I'm the captain now, in fact if not in name. But how did it happen? What have I done, what have I got?* Presently, with an inward twisting: *It must be I've less to lose. I can be more objective because I've no wife, no children, no cause, no God. It's easy for a hollow man to remain calm.*

He covered his eyes, as if to deny he floated among a million unpitying stars. But he couldn't hunch up that way for long. Someone might come back, and the captain mustn't be seen afraid.

Not afraid of death. Of life.

XIV

Seen from a view turret on the observation deck, the planet looked eerily like its parent star which had murdered it. Ryerson crouched in darkness, staring out to darkness. Against strewn constellations there lay a gigantic black outline with wan streaks and edgings of gray. As he

watched, Ryerson saw it march across the Milky Way and out of his sight. But it was the *Cross* which moved, he thought, circling her hope in fear.

I stand on Mount Nebo, he thought, *and down there is my Promised Land.*

Irrationally—but the months had made them all odd, silent introverts, Trappists because meaningful conversation was too rare and precious to spill without due heed—he reached into his breast pocket. He took forth Tamara's picture and held it close to him. Sometimes he woke up breathing the fragrance of her hair. *Have a look,* he told her. *We found it.* In a heathen adoration: *You are my luck, Tamara. You found it.*

As the black planet came back into sight, monstrously swallowing suns—it was only a thousand or so kilometers away—Ryerson turned his wife's image outward so she could see what they had gained.

"Are you there, Dave?"

Maclaren's voice came from around the cylinder of the living section. It had grown much lower in this time of search. Often you could scarcely hear Maclaren when he spoke. And the New Zealander, once in the best condition of them all, had lately gotten thinner than the other two, until his eyes stared from caves. But then, thought Ryerson, each man aboard had had to come to terms with himself, one way or another, and there had been a price. In his own case, he had paid with youth.

"Coming." Ryerson pulled himself around the deck, between the instruments. Maclaren was at his little desk, with a clipboard full of scrawled paper in one hand. Nakamura had just joined him. The Saraian had gone wholly behind a mask, more and more a polite unobtrusive robot. Ryerson wondered whether serenity now lay within the man, or the loneliest circle of hell, or both.

"I've got the data pretty well computed," said Maclaren.

Ryerson and Nakamura waited. There had been curiously little exultation when the planet finally revealed itself. *I,* thought Ryerson, *have become a plodder. Nothing is quite real out here—there is only a succession of motions, in my body and my brain—but I can celebrate no victory, because there is none, until the final and sole victory: Tamara.*

But I wonder why Terangi and Seiichi didn't cheer?

Maclaren ruffled through his papers. "It has a smaller mass and radius than Earth," he said, "but a considerably higher density suggesting it's mostly nickel-iron. No satellite, of course. And, even though the surface gravity is a bit more than Earth's, no atmosphere. Seems to be bare rock down there . . . or metal, I imagine. Solid, anyhow."

"How large was it once?" murmured Nakamura.

Maclaren shrugged. "That would be pure guesswork," he said. "I don't know which planet of the original system this is. One or two of the survivors may have crashed on the primary by now, you see. My personal guess, though, is that it was the 61

Cygni C type—more massive than Jupiter, though of less bulk because of core degeneracy. It had an extremely big orbit. Even so, the supernova boiled away all its hydrogen and probably some of the heavier elements, too. But that took time, and the planet still had this much mass left when the star decayed into a white dwarf. Of course, with the pressure of the outer layers removed, the core reverted to normal density, which must have been a pretty spectacular catastrophe in itself. Since then, the residual stellar gases have been making the planet spiral slowly inward, for hundreds of megayears. And now—"

"Now we found it," said Ryerson. "With three weeks' food supply to spare."

"And the germanium still to get," said Maclaren.

Nakamura drew a breath. His eyes went to the deck "beneath" his feet. Far aft was a storage compartment which had been left open to the bitterness of space; and a dead man, lashed to a stanchion.

"Had there been four of us," he said, "we would have consumed our supplies already and be starving. I am most humbly grateful to Engineer Sverdlov."

Maclaren's tone was dry. "He didn't die for that reason."

"No. But has he given us less, merely because it was an accident?"

They floated a while in stillness. Then Maclaren shook himself and said: "We're wasting time. This ship was never intended to land on a planet. Since I've already informed you any world we found might very likely use vacuum for sky, and you didn't object, I assume the aircraft can make a landing."

Nakamura crossed his legs and rested impassively, hands folded on his lap. "How familiar are you with the standard exploratory technique?" he inquired.

"Not very," confessed Maclaren. "I gather that aircraft are preferred for reasons of mass economy."

"And even more for maneuverability. A nuclear-powered vessel, using wings and turbojets, can rise high into an atmosphere, above the worst air resistance, without having to expend the reaction mass of a rocket. Likewise it can land more easily and safely in the first place. The aircraft which we carry, dismantled, are intended to leave their orbiting mother ship with a short rocket burst, slip into the atmosphere of a new planet, and descend. The return is more difficult, of course, but they get into the stratosphere before applying the non-ionic rocket drive. This in turn takes them into space proper, where their ion accelerators will work. Naturally, the cabins being sealed, any kind of atmosphere will serve them.

"Now, this is for exploration purposes. But these auxiliary craft are also capable of landing on rockets alone. When the time has come to establish a beam-relay station, some airless lifeless satellite is chosen, to avoid the necessity of quarantine. The craft shuttle back and forth, carrying

the ship's dismantled transceiver. This is reassembled on the surface. Thereby the satellite's own mass becomes available to the matter bank, and any amount of material can be reconstructed according to the signals from the home station. The first things sent through are usually the parts for a much larger transceiver station, which can handle many tons of mass at a time."

"Well, good," said Maclaren. "That was more or less what I thought. Let's land and—oh, oh."

Ryerson felt a smile tugging his lips, though it was not a happy one. "You see?" he murmured.

Maclaren regarded him closely. "You don't seem too discouraged," he said. "There must be an answer."

Ryerson nodded. "I've already spoken with Seiichi about it, while you were busy determining the exact characteristics of the planet. It's not going to be fun, but— Well, let him tell you."

Maclaren said slowly: "I had hoped, it was at least possible, that any planet we found would have a surviving satellite, small enough to land the whole ship on, or lay alongside if you want to consider it that way. It would have been the best thing for us. But I'm sure now that this lump has no companion of any kind. So we'll have to get our germanium down there."

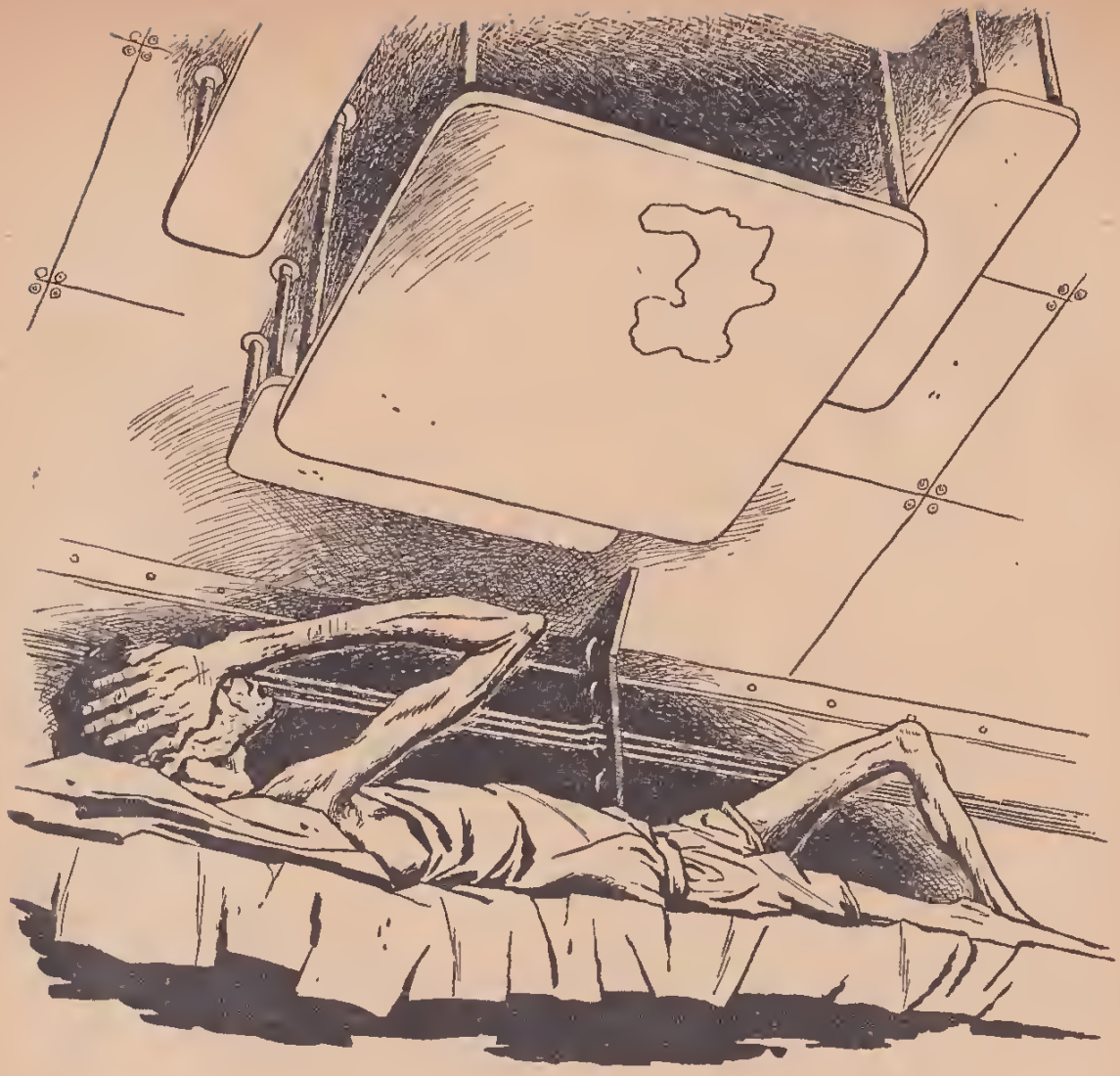
"Which we could also have done, had we been fortunate enough to locate the planet sooner," Nakamura told him. "We can take aircraft down to the surface even now. But we would have to transship all the mining and separating equipment, establish a working space and an airdome— It is too much work for three men to do before our three weeks of supplies are eaten up; and then the actual mining would still remain."

Maclaren nodded. "I should have thought of this myself," he said. "I wonder how sane and sensible we are —how can we measure rationality, when we are all the human race we know for tens of light-years? Well. So I didn't think and you didn't talk. Nevertheless, I gather there's a way out of our dilemma."

"Yes," said the pilot. "A riskful way, but any other is certain death. We can take the ship down, and use her for our ready-made workshop and airdome."

"The *Cross?* But . . . well, of course the gravitation here is no problem to her, nor the magnetism now that the drive is shielded—but we can't make a tail landing. We'd crumple the web, and . . . hell's clanging bells, she can't land at all! She's not designed for it! Not maneuverable enough, why, it takes half an hour just to swing her clear around on gyros."

Nakamura said calmly, "I have made calculations for some time now, preparing for this eventuality. There was nothing we could do before knowing what we would actually find, but I do have some plans drawn up. We have six knocked-down auxiliary craft. Yes? It will not take long to assemble their non-ionic rocket drives, which are very simple de-



vices, clamp these to the outside hull, and run their control systems through the ship's console. I think if we all work hard we can have it assembled, tested, and functioning in two or three days. Each pair of rockets should be so mounted as to form a couple which will rotate the ship around one of the three orthogonal space axes. No? Thus the spaceship will become most highly responsive to piloting. Furthermore, we shall cut up the aircraft hulls, as well as whatever else we may need and can spare for this purpose, such as interior fittings. From this, we shall construct a tripod enclosing and protecting the stern assembly. It will be clumsy and unbalanced, of course—but I trust my poor maneuverings can compensate for that—and it will be comparatively weak—but with the help of radar and our powerful ion-blast, the ship can be landed very gently."

"Hm-m-m." Maclaren rubbed his chin. His eyes flickered between the other two faces. "It shouldn't be

hard to fix those rocket motors in place, as you say. But a tripod more than a hundred meters long, for a thing as massive as this ship—I don't know. If nothing else, how about the servos for it?"

"Please." Nakamura waved his words aside. "I realize we have not time to do this properly. My plan does not envision anything with self-adjusting legs. A simple, rigid structure must suffice. We can use the radar to select a nearly level landing place."

"All places are, down there," said Maclaren. "That iron was boiling once, and nothing has weathered it since. Of course, there are doubtless minor irregularities, which would topple us on our tripod — with a thousand tons of mass to hit the ground!"

Nakamura's eyes drooped. "It will be necessary for me to react quickly," he said. "That is the risk we take."

When the ship was prepared, they met once on the observation deck, to put on their spacesuits. The hull might be cracked in landing. Maclaren and Ryerson would be down at the engine controls, Nakamura in the pilot's turret, strapped into acceleration harness with only their hands left free.

Nakamura's gaze sought Maclaren's. "We may not meet again," he said.

"Possible," said Maclaren.

The small, compact body held steady, but Nakamura's face thawed. He had suddenly, after all the time which was gone, taken on an expression; and it was gentle.

"Since this may be my last chance," he said, "I would like to thank you."

"Whatever for?"

"I am not afraid any more."

"Don't thank me," said Maclaren, embarrassed. "Something like that, a chap does for himself, y' know."

"You earned me the time for it, at least." Nakamura made a weightless bow. "*Sensei,* give me your blessing."

Maclaren said, with a degree of bewilderment: "Look here, everybody else has had more skill, contributed more, than I. I've told you a few things about the star and the planet, but you—Dave, at least—could have figured it out with slightly more difficulty. I'd never have known how to reconstruct a drive or a web, though; and I'd never be able to land this ship."

"I was not speaking of material survival," said Nakamura. A smile played over his mouth. "Still, do you remember how disorganized and noisy we were at first, and how we have grown so quiet since and work together so well? It is your doing. The highest interhuman art is to make it possible for others to use *their* arts." Then, seriously: "The next stage of achievement, though, lies within a man. You have taught me. Knowingly or not, Terangi-san, you have taught me. I would give much to be sure you will . . . have the chance . . . to teach yourself."

Ryerson appeared from the lock-

ers. "Here they are," he said. "Tin suits all around."

Maclaren donned his armor and went aft. *I wonder how much Seiichi knows. Does he know that I've stopped making a fuss about things, that I didn't exult when we found this planet, not from stoicism but merely because I have been afraid to hope?*

I wouldn't even know what to hope for. All this struggle, just to get back to Earth and resume having fun? No, that's too grotesque.

"We should have issued the day's chow before going down," said Ryerson. "Might not be in any shape to eat it at the other end."

"Who's got an appetite under present circumstances?" said Maclaren. "So postponing dinner is one way of stretching out the rations a few more hours."

"Seventeen days' worth, now."

"We can keep going, foodless, for a while longer."

"We'll have to," said Ryerson. He wet his lips. "We won't mine our metal, and gasify it, and separate out the fractional per cent of germanium, and make those transistors, and tune the circuits, in any seventeen days."

Maclaren grimaced. "Starvation, or the canned willy we've been afflicted with. Frankly, I don't think there's much difference."

Hastily, he grinned at Ryerson, so the boy would know it for a jest. Grumbling was not allowed any more; they didn't dare. And the positive side of conversation, the dreaming aloud of "when we get home," had long since worn thin. Dinner-table conversation had been a ritual they needed for a while, but in a sense they had outgrown it. Now a man was driven into his own soul. *And that's what Seiichi meant,* thought Maclaren. *Only, I haven't found anything in myself. Or, no. I have. But I don't know what. It's too dark to see.*

He strapped himself in and began checking instruments.

"Pilot to engine room. Read off!"

"Engine room to pilot. Plus voltage clear. Minus voltage clear. Mercury flow standard—"

The ship came to life.

And she moved down. Her blast slowed her in orbit, she spiraled, a featureless planet of black steel called her to itself. The path was cautious. There must be allowance for rotation; there must not be too quick a change of velocity, lest the ponderous sphere go wobbling out of control. Again and again the auxiliary motors blasted, spinning her, guiding her. The ion-drive was not loud, but the rockets roared on the hull like hammers.

And down. And down.

Only afterward, reconstructing confused memories, did Maclaren know what had happened; and he was never altogether sure. The *Cross* backed onto an iron plain. Her tripod touched, on one foot, on two. The surface was not quite level. She began to topple. Nakamura lifted her with a skill that blended main drive and auxiliaries into one smooth surge —such skill as only an utterly relaxed man could achieve, reponding to the

immense shifting forces as a part thereof. He rose a few hundred meters, changed position relative to the ground, and tried again. The tripod struck on two points once more. The ship toppled again. The third leg went off a small bluff, no more than a congealed ripple in the iron. It hit ground hard enough to buckle.

Nakamura raised ship barely in time. For an instant he poised in the sky on a single leg of flame, keeping his balance with snorts of rocket thrust. The bottom of the *Cross'* stern assembly was not many meters above ground.

Suddenly he killed the ion drive. Even as the ship fell, he spun her clear around on the rotator jets. The *Cross* struck nose first. The pilot's turret smashed, the bow caved in, automatic bulkheads slammed shut to save the air that whistled out. That was a great mass, and it struck hard. The sphere was crushed flat for meters aft of the bow. With her drive and her unharmed transceiver web aimed at the sky, the ship rested like Columbus' egg.

And the stars glittered down upon her.

Afterward Maclaren wondered: Nakamura might well have decided days beforehand that he would probably never be able to land any other way. Or he might have considered that his rations would last two men an extra week. Or perhaps, simply, he found his dark bride.

XV

The planet spun quickly about its axis, once in less than ten hours. There went never a day across its iron plains, but hunger and the stars counted time. There was no wind, no rain, no sea, but a man's radio hissed with the thin dry talk of the stars.

When he stood at the pit's edge and looked upward, Maclaren saw the sky sharp and black and of an absolute cold. It had a somehow three-dimensional effect; theory said all those crowding suns, blue-white or frosty gold or pale heatless red, were alike at optical infinity, but the mind sensed remoteness beyond remoteness, and whimpered. Nor was the ground underfoot a comfort, for it was almost as dark, starlit vision reached a few meters and was gulped down. A chopped-off Milky Way and a rising constellation—the one Maclaren had privately named Risus, the Sneer—told him that a horizon existed, but his animal instincts did not believe it.

He sighed, slapped a glare filter across his faceplate, and began cutting. The atomic hydrogen torch was lurid enough to look upon, but it jostled the stars out of his eyes. He cut rapidly, ten-kilo slabs which he kicked down into the pit so they wouldn't fuse tight again. The hole itself had originally been blasted, but the *Cross* didn't carry enough explosive for him to mine all his ore that way.

Ore, he reflected, was a joke. How would two men on foot prospect a sterilized world sealed into vacuum a hundred million years ago? And

there would have been little point in it. This planet had boiled once, at least on the surface; and even the metallic core had been heated and churned, quite probably to melting, when crushed atoms expanded to normal dimensions. The entire globe must be nearly uniform, one alloy lump. You took any piece, crushed it, gasified it, ionized it, put it through the electromagnetic isotope separator, and drew forth as much—or, rather, as minutely little—germanium as any other piece would have given you. From the known rate of extraction by such methods you could calculate when you would have four kilokrams. The date lay weeks away.

Maclaren finished cutting, shut off his torch and hung it on its generator, and climbed into the bucket of the crane at the pit's edge. His flashbeam threw puddles of light on its walls as he was lowered. At the bottom he moved painfully about, loaded the bucket, and rode back to the surface. A small electric truck waited, he spilled the bucket into its box. And then it was to do again, and still again, until he had a full load.

Thank God and her dead designers, the *Cross* was well equipped for work on airless surfaces, she carried machines to dig and build and transport. But, of course, she had to. It was her main purpose, to establish a new transceiver station on a new moon; everything else could then come straight from the Solar System.

It had been her purpose.

It still was.

Maclaren climbed wearily onto the truck seat. He and his spacesuit had a fourth again their Earth-weight here. His headlights picked out a line of paint leading toward the ship. It had been necessary to blast the pit some distance away, for fear of what ground vibrations might do to the web or the isotope separator. But then a trail had to be blazed, for nature had given no landmarks for guide, this ground was as bare as a skull.

Existence was like lead in Maclaren's bones.

After a while he made out the *Cross,* a flattened sphere crowned with a skeleton and the Orion nebula. It was no fun having everything upside down within her; a whole day had gone merely to reinstall the essential items. Well, Seiichi, you did what seemed best, and your broken body lies honored with Chang Sverdlov's, on the wide plains of iron.

Floodlights glared under the ship. Ryerson was just finishing the previous load, reducing stone to pebbles and thence to dust. Good timing. Maclaren halted his truck and climbed down. Ryerson turned toward him. The undiffused glow reached through his faceplate and picked a sunken, bearded face out of night, little more than nose and cheekbone and bristling jaw. In his unhuman armor, beneath that cavernous sky, he might have been a troll. *Or I might,* thought Maclaren. *Humanity is far from us. We have stopped bathing, shaving, dressing, cooking . . . pretending; we work till our brains go*

blank, and then work some more, and crawl up the ladder into the ship for a few hours' uneasy sleep, and are awakened by the clock, and fool our shriveled bellies with a liter of tea, and put a lump of food in our mouths and go out. For our time has grown thin.

"Hello, Nibelung," said Ryerson.

Maclaren started. "Are you getting to be a telepath?"

"It's possible," said Ryerson. His voice had become a harsh whisper. His glance searched darkness. "Anything is possible here."

"After we put this load through," said Maclaren, evading the other thought, "we'd better move the slag out of the ship. That ninety-nine-plus per cent of material we don't use piles up fast."

Ryerson clumped heavily to the truck and began unloading. "And then out once more, cutting and loading and grinding and . . . merciful God, but I'm tired! Do you really imagine we can keep on doing heavy manual work like this, after the last food has been eaten?"

"We'll have to," said Maclaren. "And, of course, there is always—" He picked up a rock. Dizziness whirled through him. He dropped the stone and sank to his knees on the ground.

"Terangi!" Ryerson's voice seemed to come from some Delphic deep, through mists. "Terangi, what's wrong?"

"Nothing," mumbled Maclaren. He pushed at the other man's groping arms. "Lea' me be . . . all right in a minute . . ." He relaxed against the stiffness of armor and let his weakness go through him in tides.

After a while, some strength returned. He looked up. Ryerson was just feeding the last rocks into the crusher. The machine ate them with a growl that Maclaren felt through the planet and his body. It vibrated his teeth together.

"I'm sorry, Dave," he said.

"'S all right. You should go up and bunk for a while."

"Just a spell. Maybe we shouldn't have cut our rations as short as we have."

"You do seem to've been losing weight even faster than me," said Ryerson. "Maybe you ought to have an extra ration."

"Nah. It's metabolic inefficiency, brought on by well-spent years of wine, women, and off-key song."

Ryerson sat down beside him. "I'm a bit short of breath myself. Let's both take a break while the stuff goes through the crusher."

"Well," said Maclaren, "if your tailbone insulators can stand it, I suppose mine can."

They remained in silence for a while. The machine rumbled in their flesh and the stars muttered in their heads.

"How long do you think it will take to prepare the web?" asked Maclaren. "I mean, what's your latest estimate?"

"Hitherto I've underestimated the time for everything," said Ryerson. "Now, I just don't know. First we'll

have to get our germanium. Then, to make the units . . . I don't know. Two weeks, three? And then, once all the circuits are functioning, they'll have to be tuned. Mostly by guesswork, since I don't really know the critical constants. That will take *x* time, depending on how lucky we are."

"We'll open the last can of food soon," said Maclaren. In itself it was a totally useless reminder, but it was leading up to something they had both avoided.

Ryerson continued to squirm: "They say tobacco helps kill appetite."

"It does," said Maclaren, "but I smoked the last butts months ago. Now I've even lost the addiction. Though of course I'll happily rebuild same the moment we strike Earth."

"When we come home—" Ryerson's voice drifted off like a murmur in sleep. "We haven't talked about our plans for a long time."

"It got to be too predictable, what every man would say."

"Yes. But is it now? I mean, do you still want to take that sailboat cruise around Earth, with . . . er . . . a female crew and a cargo of champagne?"

"I don't know," said Maclaren, faintly surprised to realize it. "I hadn't thought— Do you remember once in space, we talked about our respective sailing experiences, and you told me the sea is the most inhuman thing on our planet?"

"Hm-m-m—yes. Of course, my sea was the North Atlantic. You might have had different impressions."

"I did. Still, Dave, it has stuck in my mind, and I see now you are right. Any ocean is, is too—big, old, blind for us—too beautiful." He sought the million suns of the Milky Way. "Even this black ocean we're wrecked in."

"That's odd," said Ryerson. "I thought it was your influence making me think more and more of the sea as a . . . not a friend, I suppose. But hope and life and, oh, I don't know. I only know, I'd like to take that cruise with you."

"By all means," said Maclaren. "I didn't mean I'd become afraid of the water, just that I've looked a little deeper into it. Maybe into everything. Hard to tell, but I've had a feeling now and then, out here, of what Seiichi used to call insight."

"One does learn something in space," agreed Ryerson. "I began to, myself, once I'd decided that God hadn't cast me out here and God wasn't going to bring me back, it wasn't His part— Oh, about that cruise. I'd want to take my wife, but she'd understand about your, uh, companions."

"Surely," said Maclaren. "I'd expect that. You've told me so much about her, I feel like a family friend."

I feel as if I loved her.

"Come around and be avuncular when we've settled— Damn, I forgot the quarantine. Well, come see our home on Rama in thirty years!"

No, no, I am being foolish. The sky has crushed me back toward child.

Because she has gallant eyes and hair like a dark flower, it does not mean she is the one possible woman to fulfill that need I have tried for most of my life to drown out. It is only that she is the first woman since my mother's death whom I realize is a human being.

And for that, Tamara, I have been slipping three-fourths of my ration back into the common share, so your man may innocently take half of that for his. It is little enough I can do, to repay what you who I never saw gave to me.

"Terangi! You are all right, aren't you?"

"Oh. Oh, yes, of course." Maclaren blinked at the other armored shape, shadowy beside him. "Sorry, old chap. My mind wandered off on some or other daisy-plucking expedition."

"It's an odd thing," said Ryerson. "I find myself thinking more and more frivolously. As this cruise of yours, for instance. I really mean to join you, if you're still willing, and we'll take that champagne along and stop at every sunny island and loaf about and have a hell of a good time. I wouldn't have expected this . . . what has happened . . . to change me in that direction. Would you?"

"Why, no," said Maclaren. "Uh, I thought actually you—"

"I know. Because God seemed to be scourging me, I believed the whole creation must lie under His wrath. And yet, well, I have been on the other side of Doomsday. Here, in nightmare land. And somehow, oh, I don't know, but the same God who kindled that nova saw equally fit to . . . to make wine for the wedding at Cana."

Maclaren wondered if the boy would regret so much self-revelation later. Perhaps not if it had been mutual. So he answered with care, "Oddly enough, or maybe not so oddly, my thinking has drifted in the other direction. I could never see any real reason to stay alive, except that it was more fun than being dead. Now I couldn't begin to list all the reasons. To raise kids into the world, and learn something about the universe, and not compromise with some one's version of justice, and— I'm afraid I'm not a convert or anything. I still see the same blind cosmos governed by the same blind laws. But suddenly it matters. It matters terribly, and means something. What, I haven't figured out yet. I probably never will. But I have a reason for living, or for dying if need be. Maybe that's the whole purpose of life: purpose itself. I can't say. But I expect to enjoy the world a lot more."

Ryerson said in a thoughtful tone: "I believe we've learned to take life seriously. Both of us."

The grinder chuted its last dust into the receptacle. The gasifier was inboard; and the cold, not far from absolute zero, was penetrating the suit insulators. Ryerson got up. Shadows lapped his feet. "Of course," he said, his voice suddenly cracked, "that doesn't help us a great deal if we starve to death out here."

Maclaren rose with him. The

floodlamps ridged both their faces against the huge hollow dark. Maclaren caught Ryerson's eyes with his own. For a moment they struggled, not moving under the constellations, but sweat sprang out upon Ryerson's forehead.

"You realize," said Maclaren, "that we actually can eat for quite a while longer. I'd say, at a guess, two more months."

"No," whispered Ryerson. "No, I won't."

"You will," Maclaren told him.

He stood there another minute, to make certain of his victory, which he meant as a gift to Tamara. Then he turned on his heel and walked over to the machine. "Come on," he said, "let's get to work."

XVI

Maclaren woke up of himself. For a moment he did not remember where he was. He had been in some place of trees, where water flashed bright beneath a hill. Someone had been with him, but her name and face would not come back. There was a lingering warmth on his lips.

He blinked at the table fastened to the ceiling. He was lying on a mattress—

Yes. The *Southern Cross,* a chilly knowledge. But why had he wakened early? Sleep was the last hiding place left to him and Dave. They stood watch and watch at the web controls, and came back to their upside-down bunkroom and ate sleep. Life had shrunken to that.

Maclaren yawned and rolled over. The alarm clock caught his eye. Had the stupid thing stopped? He looked at the second hand for a while, decided that it was indeed moving. But then he had slept for, holy shark-toothed sea gods, for thirteen hours!

He sat up with a gasp. Bloodlessness went through his head. He clung to his blankets and waited for strength to come back. How long a time had it been, while his tissues consumed themselves for lack of all other nourishment? He had stopped counting hours. But the ribs and joints stuck out on him so he sometimes listened for a rattle when he walked. Had it been a month? At least it was a time spent inboard, with little physical exertion; that fact alone kept him alive.

Slowly, like a sick creature, he climbed to his feet. If Dave hadn't called him, Dave might have passed out, or died, or proven to have been only a starving man's whim. *With a host of furious fancies*—Maclaren shambled across to the shaftway. The transceiver rooms were aft of the gyros, they had been meant to be "down" with respect to the observation deck whenever there was acceleration and now they were up above. Fortunately, the ship had been designed in the knowledge she would be in free fall most of her life. Maclaren gripped a rung with both hands. *I could use a little free fall right now,* he reflected through the dizziness. He put one foot on the next rung, used that leg and both hands to pull the next foot up beside

it; now, repeat; once more; one for Father and one for Mother and one for Nurse and one for the cat and so it goes until here we are, shaking with exhaustion.

Ryerson sat at the control panel outside the receiving and transmitting chambers. It had been necessary to spotweld a chair, with attached ladder, to the wall and, of course, learn how to operate an upside-down control panel. The face that turned toward Maclaren was bleached and hairy and caved-in; but the voice seemed almost cheerful: "So you're awake."

"The alarm didn't call me," said Maclaren. He panted for air. "Why didn't you come rouse me?"

"Because I turned off the alarm in the first place."

"What?" Maclaren sat down on what had been the ceiling and stared upward.

"You'll fall apart if you don't get more rest," said Ryerson. "You've been in worse shape than me for weeks, even before the . . . the food gave out. I can sit here and twiddle knobs without having to break off every eight hours."

"Well, maybe." Maclaren felt too tired to argue.

"Any luck?" he asked after a while.

"Not yet. I'm trying a new sequence now. Don't worry, we're bound to hit resonance soon."

Maclaren considered the problem for a while. Lately his mind seemed to have lost as much ability to hold things as his fingers. Painfully, he reconstructed the theory and practice of gravitic mattercasting. Everything followed with simple logic from the fact that it was possible at all.

The signals necessarily used a pulse code, with amplitude and duration as the variables; there were tricky ways to include a little more information through the number of pulses per millisecond, if you set an upper limit to the duration of each. It all took place so rapidly that engineers could speak in wave terms without too gross an approximation. Each transceiver identified itself by a "carrier" pattern, of which the actual mattercasting signal was a modulation. The process only took place if contact had been established, that is, if the transmitter was emitting the carrier pattern of a functioning receiver: the "resonance" or "awareness" effect which beat the inverse-square law, a development of Einstein's great truth that the entire cosmos is shaped by what momentarily happens to each of its material parts.

The 'caster itself, by the very act of scanning, generated the signals which recreated the object transmitted. But first the 'caster must be tuned in on the desired receiving station. The manual aboard ship gave the call pattern of every established transceiver: but, naturally, gave it in terms of the standardized and tested web originally built into the ship. Thus, to reach Sol, the book said, blend its pattern with that of Rashid's Star, the initial relay station in this particular case. Your signal will be automatical-

ly bucked on, through several worlds, till it reaches Earth's Moon. Here are the respective voltages, oscillator frequencies, et cetera, involved; add them up and use the resultant.

Ryerson's handmade web was not standardized. He could put a known pattern into it, electronically, but the gravitics would emit an unknown one, the call signal of a station not to be built for the next thousand years. He lacked instruments to measure the relationship, so he could not recalculate the appropriate settings. It was cut and try, with a literal infinity of choices and only a few jackleg estimates to rule out some of the possibilities.

Maclaren sighed. A long time had passed while he sat thinking. Or so his watch claimed. He hadn't noticed it go by, himself.

"You know something, Dave?" he said.

"Hm-m-m?" Ryerson turned a knob, slid a vernier one notch, and punched along a row of buttons.

"We are out on the far edge of no place. I forget how far to the nearest station, but a devil of a long ways. This haywire rig of ours may not have the power to reach it."

"I knew that all the time," said Ryerson. He slapped the main switch. Needles wavered on dials, oscilloscope tracings glowed elfhill green, it whined in the air. "I think our apparatus is husky enough, though. Remember, this ship has left Sol farther behind than any other ever did. They knew she would—a straight-line course would just naturally outrun the three-dimensional expansion of our territory—so they built the transceiver with capacity to spare. Even in its present battered state, it might reach Sol directly, if conditions were just right."

"Think we will? That would be fun."

Ryerson shrugged. "I doubt it, frankly. Just on a statistical basis. There are so many other stations by now— *Hey!*"

Maclaren found himself on his feet, shaking. "What is it?" he got out. "What is it? For the love of heaven, Dave, what is it?"

Ryerson's mouth opened and closed, but no sounds emerged. He pointed with one bony arm. It shook.

Below him—it was meant to be above, like a star—a light glowed red.

"Contact," said Maclaren.

The word echoed through his skull as if spoken by a creator, across a universe still black and empty.

Ryerson began to weep, silently, his lips working. "Tamara," he said. "Tamara, I'm coming home."

Maclaren thought: *If Chang and Seiichi had been by me now, what a high and proud moment.*

"Go on, Terangi," chattered Ryerson. His hands shook so he could not touch the controls. "Go on through."

Maclaren did not really understand it. Not yet. It was too swift a breaking. But the wariness of a race which had evolved among snakes and war spoke for him:

"Wait, Dave. Wait a minute. Just to be certain. Put a signal through.

A teletype, I mean; we've no voice microphone, have we? You can do it right at that keyboard."

"What for?" screamed Ryerson. "What for? If you won't go through, I will!"

"Just wait, is all." Suddenly Maclaren was begging. All the craziness of months between stars that burned his eyes woke up; he felt in a dim way that man must live under conditions and walk in awe, but this is one of the prides in being a man. He raised powerless hands and cried—it was not much above a whisper—"There could be some distortion, you know. Accidents do happen, once in a great while, and this web was made by hand, half of it from memory—Send a message. Ask for a test transmission back to us. It won't take long and— My God, Dave, what kind of thing could you send home to Tamara if the signal was wrong?"

Ryerson's chin quivered in its beard, but he punched the typer keys with hard angry strokes. Maclaren sat back down, breathing quickly and shallowly. So it was to become real after all. So he would again walk beneath the tall summer clouds of Earth.

No, he thought. *I never will. Terangi Maclaren died in an orbit around the black sun, and on the steel planet where it is always winter. The I that am may go home, but never the I that was.*

Ryerson bent over so he could look into the screen which gave him an image of the receiving chamber.

Maclaren waited. A long while passed.

"Nothing," said Ryerson. "They haven't sent a thing."

Maclaren could still not talk.

"A colonial station, of course," said Ryerson. "Probably one of the outpost jobs with two men for a staff . . . or, another spaceship. Yes, that's likeliest, we're in touch with an interstellar. Only one man on watch and—"

"And there should be a bell to call him, shouldn't there?" asked Maclaren, very slowly.

"You know how they get on the long haul," said Ryerson. He smote his chair arm with a fist that was all knobs. "The man is sleeping too hard to hear a thing. Or—"

"Wait," said Maclaren. "We've waited long enough. We can afford a few more minutes, to make certain."

Ryerson blazed at him, as if he were an enemy. "Wait? Wait, by jumping hell! No!"

He set the control timer for transmission in five minutes and crept from his seat and down the ladder. Under the soiled tunic, he seemed all spidery arms and legs, and one yellow shock of hair.

Maclaren stood up again and stumbled toward him. "No," he croaked. "Listen, I realize how you feel, but I realize it's space lunacy too, and I forbid you, I forbid—"

Ryerson smiled. "How do you propose to stop me?" he asked.

"I . . . but can't you wait, wait and see and—"

"Look here," said Ryerson, "let's

assume there is a freak in the signal. A test transmission comes through. At best, the standard object is merely distorted . . . at worst, it won't be recreated at all, and we'll get an explosion. The second case will destroy us. In the first case, we haven't time to do much more work. I doubt if I could climb around on the web outside any more. I know you could not, my friend! We've no choice but to go through. Now!"

"If it's a ship at the other end, and you cause an explosion," whispered Maclaren, "you've murdered one more man."

Drearily, and as if from far away, he recognized the hardness which congealed the other face. Hope had made David Ryerson young again. "It won't blow up," said the boy, and was wholly unable to imagine such a happening.

"Well . . . probably not . . . but there's still the chance of molecular distortion or—" Maclaren sighed. Almost experimentally, he pushed at Ryerson's chest. Nothing happened; he was so much more starved that he could not move the lank body before him.

"All right," said Maclaren. "You win. I'll go through."

Ryerson shook his head. "No, you don't," he answered. "I changed my mind." With a lilt of laughter: "I stand behind my own work, Terangi!"

"No, wait! Let me . . . I mean . . . think of your wife, at least . . . please—"

"I'll see you there," cried Ryerson. The blue glance which he threw over his shoulder was warm. He opened the transmitter room door, went through, it clashed shut upon him. Maclaren wrestled weakly with the knob. No use, it had an automatic lock.

Which of us is the fool? I will never be certain, whatever may come of this. The chances are all for him, of course . . . in human terms, reckoned from what we know . . . but could he not learn with me how big this universe is, and how full of darkness?

Maclaren stumbled back toward the ladder to the chair. He would gain wrath, but a few more minutes, by climbing up and turning off the controls. And in those minutes, the strangely, terrifying negligent operator at the other end might read the teletype message and send a test object. And then Ryerson would know. Both of them would know. Maclaren put his feet on the rungs. He had only two meters to climb. But his hands would not lift him. His legs began to shake. He was halfway to the panel when its main switch clicked down and the transmitting engine skirled.

He crept on up. *Now I know what it means to be old,* he thought.

His heart fluttered feebly and wildly as he got into the chair. For a while he could not see the vision screens, through the night that spumed in his head. Then his universe steadied a little. The transmitter room was quite empty. The red light

still showed contact. So at least there had been no destruction wrought in the receiving place. Except maybe on Dave; it didn't take much molecular warping to kill a man. *But I am being timid in my weakness. I should not be afraid to die. Least of all to die. So let me also go on through and be done.*

He reached for the timer. His watch caught his eye. Half an hour since Dave left? Already? Had it taken half an hour for him to creep this far and think a few sentences? But surely Dave would have roused even the sleepiest operator. They should have sent a teletype to the *Cross*: "Come on, Terangi. Come on home with me." What was wrong?

Maclaren stared at the blank walls enclosing him. Here he could not see the stars, but he knew how they crowded the outside sky, and he had begun to understand, really understand what an illusion that was and how hideously lonely each of those suns dwelt.

One thing more I have learned, in this last moment, he thought. *I know what it is to need mercy.*

Decision came. He set the timer for ten minutes—his progress to the transmitter room would be very slow—and started down the ladder.

A bell buzzed.

His heart sprang. He crawled back, feeling dimly that there were tears on his own face now, and stared into the screen.

A being stood in the receiving chamber. It wore some kind of armor, so he could not make out the shape very well, but though it stood on two legs the shape was not a man's. Through a transparent bubble of a helmet, where the air within bore a yellowish tinge, Maclaren saw its face. Not fish, nor frog, nor mammal, it was so other a face that his mind would not wholly register it. Afterward he recalled only blurred features, there were tendrils and great red eyes.

Strangely, beyond reason, even in that first look he read compassion on the face.

The creature bore David Ryerson's body in its arms.

XVII

Where Sunda Straits lay beneath rain—but sunlight came through to walk upon the water—the land fell steep. It was altogether green, in a million subtle hues, jungle and plantation and rice paddy, it burned with green leaves. White mists wreathed the peak of a volcano, and was it thunder across wind or did the mountain talk in sleep?

Terangi Maclaren set his aircar down on brown-and-silver water and taxied toward the Sumatra shore. Each day he regained flesh and strength, but the effort of dodging praus and pontoon houses and submarines still tired him. When his guide pointed: "There, tuan," he cut the engines and glided in with a sigh.

"Are you certain?" he asked, for there were many such huts of thatch and salvaged plastic along this coast. It was a wet world here, crowding

brown folk who spent half their cheerful existences in the water, divers, deckhands, contracting their labor to the sea ranches but always returning home, poverty, illiteracy, and somehow more life and hope than the Citadel bore.

"Yes, tuan. Everyone knows of her. She is not like the rest, and she holds herself apart. It marks her out."

Maclaren decided the Malay was probably right. Tamara Suwito Ryerson could not have vanished completely into the anonymous proletariat of Earth. If she still planned to emigrate, she must at least leave a mailing address with the Authority. Maclaren had come to Indonesia quickly enough, but there his search widened, for a hundred peope used the same P.O. in New Djakarta and their homes lay outside the cosmos of house numbers and phone directories. He had needed time and money to find this dwelling.

He drove up onto the shore. "Stay here," he ordered his guide, and stepped out. The quick tropic rain poured over his tunic and his skin. It was the first rain he had felt since . . . how long? . . . it tasted of morning.

She came to the door and waited for him. He would have known her from the pictures, but not the grace with which she carried herself. She wore a plain sarong and blouse. The rain filled her crow's-wing hair with small drops and the light struck them and shattered.

"You are Technic Maclaren," she

said. He could scarcely hear her voice, so low did it fall, but her eyes were steady on his. "Welcome."

"You have seen me on some newscast?" he inquired, banally, for lack of anything else.

"No. I have only heard. Old Prabang down in the village has a nonvisual set. But who else could you be? Please come in, sir."

Only later did he realize how she broke propriety. But then, she had declared herself free of Protectorate ways months ago. He found that out when he first tried to contact her at her father-in-law's. The hut, within, was clean, austerely furnished, but a vase of early mutation-roses stood by David's picture.

Maclaren went over to the cradle and looked down at the sleeping infant. "A son, isn't it?" he asked.

"Yes. He has his father's name."

Maclaren brushed the baby's cheek. He had never felt anything so soft. "Hello, Dave," he said.

Tamara squatted at a tiny brazier and blew up its glow. Maclaren sat down on the floor.

"I would have come sooner," he said, "but there was so much else, and they kept me in the hospital—"

"I understand. You are very kind."

"I . . . have his effects . . . just a few things. And I will arrange the funeral in any way you desire and—" His voice trailed off. The rain laughed on the thatch.

She dipped water from a jar into a tea kettle. "I gather, then," she said, "there was no letter that he wrote?"

"No. Somehow . . . I don't know. For some reason none of us wrote any such thing. Either we would all perish out there, and no one else would come for fifty or a hundred years, or we would get back. We never thought it might be like this, a single man." Maclaren sighed. "It's no use trying to foresee the future. It's too big."

She didn't answer him with her voice.

"But almost the last thing Dave said," he finished awkwardly, "was your name. He went in there thinking he would soon be home with you." Maclaren stared down at his knees. "He must have . . . have died quickly. Very quickly."

"I have not really understood what happened," she said, kneeling in the graceful Australian style to set out cups. Her tone was flattened by the effort of self-control. "I mean, the 'cast reports are always so superficial and confused, and the printed journals so technical. There isn't any middle ground any more. That was one reason we were going to leave Earth, you know. Why I still am going to, when our baby has grown just a little bit."

"I know how you feel," said Maclaren. "I feel that way myself."

She glanced up with a startled flirt of her head that was beautiful to see. "But you are a technic!" she exclaimed.

"I'm a human being too, my lady. But go on, ask me your question, whatever you were leading up to.

I've a favor of my own to ask, but you first."

"No, what do you want? Please."

"Nothing very important. I've no claim on you, except the fact that your husband was my friend. I'm thinking of what you might do for his sake. But it will wait. What did you wonder about?"

"Oh. Yes. I know you tuned in the aliens' transceiver and didn't realize it. But—" Her fists clenched together. She stared through the open door, into the rain and the light, and cried forth: "It was such a tiny chance! Such a meaningless accident that killed him!"

Maclaren paused until he had all his words chosen. Then he said, as gently as might be:

"It wasn't so wildly improbable. All this time we've known that we couldn't be the only race reaching for the stars. It was absurd to think so; that would have been the senseless unlikelihood. Well, the *Cross* was farther out than men had ever gone before, and the alien spaceship was near the aliens' own limit of expansion. It was also bound for Alpha Crucis. Odd what a sense of kinship that gives me, my brother mariner, with chlorine in his lungs and silicon in his bones, steering by the same lodestar. Contact was certain eventually, as they and we came into range of each other's signals. Your David was the man who first closed the ring. We were trying call patterns we could not measure, running through combinations of variables. Statistically, we were as likely to strike one of their patterns as one of ours."

The water began to boil. She busied herself with the kettle. The long tresses falling past her face hid whether she was crying or not. Maclaren added for her, "Do you know, my lady, I think we must have called hundreds of other space-traveling races. We were out of their range, of course, but I'm sure we called them."

Her voice was muffled: "What did the aliens think of it?"

"I don't know. In ten years we may begin to talk to them. In a hundred years, perhaps we will understand them. And they us, I hope. Of course, the moment David . . . appeared . . . they realized what had happened. One of them came through to me. Can you imagine what courage that must have taken? How fine a people your man has given us to know? There was little they could do for me, except test the *Cross'* web and rule out all the call patterns which they use. I kept on trying, after that. In a week I finally raised a human. I went through to his receiver and that's all. Our technicians are now building a new relay station on the black star planet. But they'll leave the *Cross* as she is, and David Ryerson's name will be on her."

"I thought," she whispered, still hiding her face, "that you . . . I mean, that quarantine rules—"

"Oh, yes, the Protectorate tried to invoke them. Anything to delay what is going to happen. But it was useless.

Nothing from the aliens' planet could possibly feed on Terrestrial life. That's been established already, by the joint scientific commission; we may not be able to get the idea behind each other's languages yet, but we can measure the same realities! And of course, the aliens know about us. Man just can't hide from the universe. So I was released." Maclaren accepted the cup she offered him and added wryly: "To be sure, I'm not exactly welcome at the Citadel any more."

She raised large eyes to him. He saw how they glimmered. "Why not?" she asked. "You must be a hero to—"

"To spacemen, scientists, some colonials, and a few Earthmen glad of an end to stagnation. Not that I deserve their gratitude. There are three dead men who really did all this. But at any rate, my lady, you can foresee what an upheaval is coming. We are suddenly confronted with— Well, see here, the aliens must be spread through at least as large a volume of space as man. And the two races don't use the same kind of planets. By pooling transceiver networks, we've doubled both our territories! No government can impose its will on as many worlds as that.

"But more. There are sciences, technologies, philosophies, religions, arts, insights they have which we never imagined. It cannot be otherwise. And we can offer them ours, of course. How long do you think this narrow little Protectorate and its narrow little minds can survive such an explosion of new thought?" Maclaren leaned forward. He felt it as an upsurge in himself. "My lady, if you want to live on a frontier world, and give your child a place where it's hard and dangerous and challenging —and everything will be possible for him, if he's big enough—stay on Earth. The next civilization will begin here on Earth herself."

Tamara set down her cup. She bent her face into her hands and he saw, helpless, how she wept. "It may be," she said to him, "it may be, I don't know. But why did it have to be David who bought us free? Why did it have to be him? He didn't mean to. He wouldn't have, if he'd known. I'm not a sentimental fool, Maclaren-san, I know he only wanted to come back here. And he died! There's no meaning in it!"

XVIII

The North Atlantic rolled in from the west, gray and green and full of thunder. A wind blew white manes up on the waves. Low to the south gleamed the last autumnal daylight, and clouds massed iron-colored in the north, brewing sleet.

"There," pointed Tamara. "That is the place."

Maclaren slanted his aircar earthward. The sky whistled around him. So Dave had come from here. The island was a grim enough rock, harshly ridged. But Dave had spoken of gorse in summer and heather in fall and lichen of many hues.

The girl caught Maclaren's arm. "I'm afraid, Terangi," she whispered. "I wish you hadn't made me come."

"It's all we can do for David," he told her. "The last thing we'll ever be able to do for him."

"No." In the twilight, he saw how her head lifted. "There's never an end. Not really. His child and mine, waiting, and— At least *we* can put a little sense into life."

"I don't know whether we do or whether we find what was always there," he replied. "Nor do I care greatly. To me, the important thing is that the purpose—order, beauty, spirit, whatever you want to call it—does exist."

"Here on Earth, yes," she sighed. "A flower or a baby. But then three men die beyond the sun, and it so happens the race benefits a little from it, but I keep thinking about all those people who simply die out there. Or come back blind, crippled, broken like dry sticks, with no living soul the better for it. Why? I've asked it and asked it, and there isn't ever an answer, and finally I think that's because there isn't any why to it in the first place."

Maclaren set the car down on the beach. He was still on the same search, along a different road. He had not come here simply to offer David's father whatever he could: reconciliation, at least, and a chance to see David's child now and then in the years left him. Maclaren had some obscure feeling that an enlightenment might be found on Skula.

Truly enough, he thought, men went to space, as they had gone to sea, and space destroyed them, and still their sons came back. The lure of gain was only a partial answer; spacemen didn't get any richer than sailors had. Love of adventure . . . well, in part, in some men, and yet by and large the conquerors of distance had never been romantics, they were workaday folk who lived and died among sober realities. When you asked a man what took him out to the black star, he would say he had gone under orders, or that he was getting paid, or that he was curious about it, or any of a hundred reasons. Which might all be true. And yet was any of them the truth?

And why, Maclaren wondered, did man, the race, spend youth and blood and treasure and all high hopes upon the sea and the stars? Was it only the outcome of meaningless forces—economics, social pressure, maladjustment, myth, whatever you labeled it—a set of chance-created vectors with the sardonic resultant that man broke himself trying to satisfy needs which could have been more easily and sanely filled at home?

If I could get a better answer than that, thought Maclaren, *I could give it to Tamara. And to myself. And then we could bury our dead.*

He helped her out of the car and they walked up a path toward an ancient-looking cottage. Light spilled from its windows into a dusk heavy with surf. But they had not quite reached it when the door opened and a man's big form was outlined.

"Is that you, Technic Maclaren?" he called.

"Yes. Captain Magnus Ryerson?" Maclaren stepped ahead of Tamara and bowed. "I took the liberty, sir, of bringing a guest with me whom I did not mention when I called."

"I can guess," said the tall man. "It's all right, lass. Come in and welcome."

As she passed over the uneven floor to a chair, Tamara brushed Maclaren and took the opportunity to whisper: "How old he's grown, all at once!"

Magnus Ryerson shut the door again. His hands, ropy with veins, shook a little. He leaned heavily on a cane as he crossed the room and poked up the fire. "Be seated," he said to Maclaren. "When I knew you were coming, I ordered some whiskey from the mainland. I hope it's a good make. I drink not, you see, but be free to do so yourself."

Maclaren looked at the bottle. He didn't recognize the brand. "Thank you," he said, "that's a special favorite of mine."

"You've eaten?" asked the old man anxiously.

"Yes, thank you, sir." Maclaren accepted a glass. Ryerson limped over the floor to give Tamara one.

"Can you stay the night? I've some extra beds in the garret, from when the fisher lads would come by. They come no more, there's no reason for it now, but I've kept the beds."

Maclaren traded a look with Tamara. "We would be honored," he said.

Magnus Ryerson shuffled to the hob, took the tea kettle, poured himself a cup and raised it. "Your health." He sat down in a worn chair by the fire. His hands touched a leather-bound book lying on its arm.

There was silence for a while, except that they could all hear the waves boom down on the strand.

Maclaren said finally: "I . . . we, I mean . . . we came to—offer our sympathy. And if there was anything I could tell you . . . I was there, you know."

"Aye. You're kind." Ryerson groped after a pipe. "It is my understanding he conducted himself well."

"Yes. Of course he did."

"Then that's what matters. I'll think of a few questions later, if you give me time. But that was the only important one."

Maclaren looked around the room. Through its shadows he saw pilot's manuals on the shelves, stones and skins and gods brought from beyond the sky; he saw the Sirian binary like twin hells upon darkness, but they were very beautiful. He offered: "Your son was in your own tradition."

"Better, I hope," said the old man. "There would be little sense to existence, did boys have no chance to be more than their fathers."

Tamara stood up. "But that's what there isn't!" she cried all at once. "There's no sense! There's just dying and dying and dying. What for? So that we can walk on another planet, learn another fact? What have we

gained? What have we really done? And why? What did we do that your god send our men out there now?"

She clamped her hands together. They heard how the breath rasped in her. She said at last, "I'm sorry," and sat back down.

Magnus Ryerson looked up. And his eyes were not old. He let the surf snarl on the rocks of his home for a while. And then he answered her: *"'For that is our doom and our pride.'"*

"What?" She started. "Oh. In English. Terangi, he means—" She said it in Interhuman.

Maclaren sat quite still.

Ryerson opened his book. "They have forgotten Kipling now," he said. "One day they will remember. For no people live long, who offer their young men naught but fatness and security. Tamara, lass, let your son hear this one day. It is his song too, he is human."

The words were unknown to Maclaren, but he listened and thought he understood.

"We have fed our sea for a thousand years
And she calls us, still unfed,
Though there's never a wave of all her waves
But marks our English dead:
We have strawed our best to the weed's unrest,
To the shark and the sheering gull,
If blood be the price of admiralty,
Lord God, we ha' paid it in full!—"

When Ryerson had finished, Maclaren stood up, folded his hands and bowed. *"Sensei,"* he said, "give me your blessing."

"What?" The other man leaned back into shadows, and now he was again entirely old. You could scarcely hear him under the waves outside. "You've naught to thank me for, lad."

"No, you gave me much," said Maclaren. "You have told me why men go, and it isn't for nothing. It is because they are men."

THE REFERENCE LIBRARY

BY P. SCHUYLER MILLER

ALTER EGOS

THERE is no reason why a good writer should be restricted to one type of book. Our more demanding critics insist over and over again that all writing should meet the same standards, whether it is science fiction, mystery or a candidate for Nobel Prize honors. Practically, though, we do tend to identify a given writer with a special field, and with a subdivision in that field.

The compartmenting may be quite justified: the writer may be working at the thing he does best and enjoys most—the thing he wants to do. Yet we all know that pen names often cover more than the desire to turn out more than the market seems to warrant. Lewis Padgett had a different personality from Henry Kuttner, and Don A. Stuart seemed to be an utterly different person than John W. Campbell, Jr.

In the last several months a number

of writers who have identified themselves with science fiction or fantasy, or both, have published good books of very different kinds. There have been two "straight," serious novels . . . two historical novels . . . and probably more mysteries than I know about. You may be interested in sampling the work of these "alter egos" of some familiar friends.

Of the lot, the biggest critical acclaim went last year to Ray Bradbury's "Dandelion Wine" (Doubleday, $3.95). This might have been predicted, for Bradbury is the author through whom the upper-upper-egg-heads discovered science fiction and for a short time patronized it. This might also have been predicted, for Bradbury's outstanding qualities have been the ones that these people understand: a very strong and distinctive style, simple themes that are strongly black-and-white, no difficult concepts of the sort that make "The Cold Equations" a storm center, and what is called an "antiscientific" attitude toward values and characteristics that these people suppose their stereotype of a scientist to have.

These same characteristics are what's right and what's wrong with "Dandelion Wine." The book purports to look back nostalgically to two boys, fourteen-year-old Douglas Spaulding and his ten-year-old brother Tom, living in a small Illinois town in the summer of 1928. Their experiences of that summer . . . berry picking . . . making dandelion wine . . . sampling old people's memories . . . living in a multi-generation family . . . are supposed to be typical of that time. I experienced them, only a little older, in an upstate New York small town, at the same time. But in Bradbury's book they have the wrong ring to them. The people speak and think as the author does, in the same artificial style, consciously poetic. There are the fine flashes of insight that we expect of Bradbury: the boys' discovery that an old man's memories are the true time machine . . . the ritual of the lawnmower. But the only episode that seems true and human and real is the quiet "affair" of a young reporter and a ninety-five-year-old woman, that somehow escapes from the shell of the author's stylistic restrictions and becomes real and alive.

By contrast, almost all the people in Fredric Brown's first serious novel, "The Office" (Dutton, $3.50) come alive. This is also a bit of nostalgia —Fred Brown at eighteen, remembering his first job in a Cincinnati office, in 1922—a much smaller microcosm than Bradbury's, and less crammed with cosmic significance. The critics haven't been very interested, and perhaps all the author is really saying is the old truism that there's a story behind every face, if you can find it. But Brown's 1922 is far more real than Bradbury's 1928, and his people come and go of their own initiative instead of posing like hand-puppets while their author reads their lines.

Fredric Brown has done some good science fiction and some very good mysteries; it's pure chance that I can't

tag him in that category as well. With "The Office" he has proved that there are other kinds of books in him as well.

I suppose that a span of two hundred fifty years can scarcely be called "nostaligia," and it would be doing Edgar Pangborn an injustice to call his "Wilderness of Spring" (Rinehart, $4.95) merely a nostalgic novel. The spring of his title is the boyhood of Ben and Reuben Cory; brought up in the frontier settlement of Deerfield, Massachusetts, they are orphaned in the French and Indian attack in 1704, escape into the forest, and finally find haven with their nonconformist great-uncle in Roxbury, where they slowly explore the wilderness of experiences and emotions through which they painfully and joyously trace a path to manhood.

Edgar Pangborn should be remembered as the author of one very good book of interplanetary exploration, "West of the Sun," and a more-than-very-good novel on the Martians-among-us theme, "Mirror for Observers." The latter is certainly one of the best science-fiction novels we have had. To make any part of the past come alive, as a place for people to live and not as a stage set, is much the same kind of task as creating a consistent future in the Heinlein manner. In "Wilderness of Spring" the two boys are far more believable than Doug and Tom Spaulding, and the Roxbury of two hundred fifty years ago is a more understandable place than Green Town, Illinois, only thirty years ago. Young Ben's yearning for the sea, that leads him through forced piracy to manhood, is something that had to happen to him, and sensitive, intelligent Reuben could find an outlet only in some such calling as medicine. Other-worldlings or colonial Yankees, Edgar Pangborn is the kind of gifted writer who can make any people warm and real and a part of their times.

This, unfortunately, is what L. Sprague de Camp does not manage to do in *his* first long historical novel, "An Elephant for Aristotle" (Doubleday, $3.95). Alexander the Great's world of twenty-three hundred years ago is never as real as was the declining Rome in the author's classic "Lest Darkness Fall." The struggle of Leon of Atrax to get Alexander's gift of an elephant clear across the face of the known world, from the banks of the Indus to the suburbs of Athens, is full of fascinating incident but it remains an intellectual adventure rather than something that happened to real people. By contrast, Talbot Mundy's "Tros of Samothrace"—just republished by Gnome Press at $4.95—is probably hokum, full of anachronistic flaws, yet the Caesar of that sprawling historic adventure takes on three solid dimensions in a way that only Leon himself comes close to doing.

The flaw, I think, is the same one that makes Mike Todd's fabulously successful "Around the World in Eighty Days" no more than an entertainment. Both the book and the film are like strings of almost identical beads—separate little episodes, each

lovingly constructed, held together only by the continuity of the central characters. The worried, self-deprecating professional soldier, Leon, does add up to more than a shadow, and the most believable part of the book comes when he finds himself at home in Thessaly, with his own people. This may be a case of art becoming too much of a good thing, for the person Leon is *would* take exactly this matter-of-fact view of his amazing journey, but a hero can be too self-effacing. (There's an interesting gimmick, by the way, that is logical but somewhat annoying. Sprague illustrates the big differences in Greek dialects by having his northerners speak to each other in broad Scots, his Athenians employ a kind of cockney, and some of his southerners use a "you-all" drawl. I'm afraid it gets in the way; luckily they speak good English—"general Greek"— to each other.)

It's no news, of course, that detective-mystery fiction has pretty well earned its place in the critical sun, and that some books of this type are of serious novel status. William P. McGivern was a power in the old *Amazing Stories,* in its Chicago days. He was hardly a major figure in science fiction, but someone—perhaps *Amazing*'s editor, Howard Browne—helped him become a very outstanding member of the top rank in American mystery writing. His new book, "Odds Against Tomorrow" (Dodd, Mead, $3.50), should by rights have been discussed back with Bradbury and Brown, for it is a novel about criminals and not a crime story at all. Its two central characters—and they are surrounded by other real persons —are an insecure, self-brutalized professional Texan and a quiet, educated northern Negro who have been thrown together in a patched-together gang of would-be bank robbers, and who must depend on each other for their lives and hope of freedom when the attempt fails. It's a book that should rank with the best crime novels of the year.

Henry Kuttner, whose sudden death last spring, followed by that of C. M. Kornbluth, left two gaping holes in the ranks of our best science-fiction writers, wrote four unusually good paperback mysteries with a psychoanalyst as the detective. I've read only three of the four, and the last, "Murder of a Wife," (Permabooks No. M-4096; 35¢), is the best of them. The structure of plot, clues, undercover and overt crime, is in the tradition of the genre, but Michael Gray solves his crimes by first solving the personalities of the people involved. It's hard to understand why this top-notch series was not published in hard covers.

Leigh Brackett's "An Eye for an Eye" fortunately has the Doubleday imprint ($2.95), which should mean good sales before the paperbacks move in on it. This is by no means as good a book as her striking "The Tiger Among Us," which brought a fresh aspect to the overdone juvenile delinquency theme, but it's still a very good job and as unlike the au-

thor's highly colored interplanetary fantasies as anything could be. It's a pure suspense yarn, with a near-psychopath taking revenge on the lawyer who helped his wife get a divorce, by kidnaping the lawyer's own wife.

Are these books better than the same authors' science-fiction books, simply because they are not SF? The general reading public may think so, but I deny it. One difference is that these books deal with things we know or think we know, and in this respect Sprague de Camp had the hardest task on his hands, for I doubt that any but the most erudite scholars know as much about Alexander's Greece and Persia as this book reveals offhandedly. Yet Edgar Pangborn, in his journey into the past, gives us a real New England and not the stereotype, and Ray Bradbury, for his part, creates a town that exists nowhere but in the Bradbury imagination.

To me, these books show that the kind of writer who does good science fiction will develop the skills that enable him to write other good books—if he wants to. It's by no means as easy for a writer who is good in other fields to learn the special disciplines of SF. But if you've liked Bradbury, Brown, de Camp, Pangborn, McGivern, Kuttner and Brackett in their SF personalities, why not give these *alter egos* of theirs a try?

* * *

Our contemporary, *Infinity,* has entered the award-giving sweepstakes with the first of a series of annual plaques to "best" books in the science-fiction field. I agree almost unreservedly with the award of the "best novel" prize to Rex Gordon's "First on Mars," published in the United States only as an Ace paperback. The hedging is because I don't know how I'd choose between Gordon's superb documentary and Rachel Maddux's "Green Kingdom," if that fabulous novel were eligible.

There was little competition in the short-story field in 1957, the year for which the *Infinity* awards were made. The plaque went to Jack Finney's collection of science fiction and fantasies from the big general-circulation magazines, "The Third Level." A special award went to the practically indescribable trio of SF and fantasy by William Golding, John Wyndham and Mervyn Peake which Ballantine brought out here as "Sometime, Never."

The choice of the "best science book of interest to SF readers" could have gone to only one book, the latest edition of Willy Ley's "Rockets, Missiles and Space Travel." It will take a more-than-exceptional book to get this plaque in any year that Willy's updating his classic of rocket history.

THREE TIMES INFINITY, edited by Leo Margulies. Gold Medal Books, New York. No. S-723. 1958. 176 pp. 35¢

The three novelettes in this collection are definitely old fashioned.

"Lorelei of the Red Mist," by Leigh Brackett and Ray Bradbury was in *Planet Stories* in 1946. Theodore Sturgeon's "The Golden Helix" was in *Thrilling Wonder* in 1954 (for a wonder, Gold Medal credits the sources), and "Destination Moon," I'm told, was written by Robert A. Heinlein *after* the film was scripted, and appeared in *Short Stories* in 1950.

I don't know what proportion of "Lorelei" can be attributed to Bradbury, but I can't see that it adds much to this item in Leigh Brackett's fondly remembered series of yarns about Venus. These were color-and-action swashbucklers in the mood of Howard's "Conan" and Moore's "Northwest Smith," fantasies that fall into the SF category only because they are built on the thesis that Venus is like this. Here an escaping crook is mentally kidnaped, slipped into the body of a traitorous warrior named Conan, and used in a triangular battle among a fish people living at the bottom of a sea of crimson non-water, their amphibious rivals, and humans with good Celtic names. The pure Brackett tales in this series that I've read were better.

The Sturgeon contribution takes three couples from Earth, hibernating their way through space on their way to a far planet, and drops them on a farther, stranger world as captives of the helical entities. The story is built around an evolutionary gimmick that is reminiscent of—but completely different from—the one Edgar Rice Burroughs used in "The Land That Time Forgot." In this one Sturgeon was just exercising his fingers.

Finally, the Heinlein script is the mere skeleton of a film that was in no way notable for its plot, and much too short to show the usual Heinlein brand of three-dimensional background. I'll give it this: the characters are less silly than some of them appeared in the film.

A time-passer that you may not bother to keep.

THE MIDWICH CUCKOOS, by John Wyndham. Ballantine Books, New York. 1958. 247 pp. $3.50

It's beginning to look as if "John Wyndham" can do no wrong. By mid-February he had already given us what may very well be voted the best SF novel of '58, which MGM is making into what I pray will not be the worst SF movie of '59.

My doubts about MGM stem from the ostensible gimmick of the book. European cuckoos, like American cowbirds, save themselves no end of trouble by laying their eggs in other birds' nests and letting the poor foster-parents feed the gangling, lubberly changelings as best they can. And one memorable September 26th a crew of interplanetary cuckoos set their UFO down in the sleepy English hamlet of Midwich, and install sixty golden-eyed, curly-headed, telepathic monstrosities in the bodies of as many unconscious foster-mothers, aged seventeen on up.

Given this much, and you have

visions of a sniggering farce along the lines of "Mr. Adam"—but if that's what you expect, you don't know John Wyndham. Because he plays his story every bit as straight as he did in "Day of the Triffids" or "Out of the Deeps" or "Re-Birth," though with all the wry charm of the yarns in his "Tales of Gooseflesh and Laughter." The mystery of what happened in Midwich is followed by the greater mystery of what the changelings will be . . . and this is a mystery that grows and takes over the book, until it is clear that we are watching Man supplanted by Superman. This is no farce, then: it is "Odd John," watched from outside; it is "Sirius"; it is "Slan" if all the slans were Snakes. It is this serious aspect of the book that Hollywood may not even attempt to develop, or may make ridiculously commonplace.

If the mantle of H. G. Wells has fallen on any English writer, it is on John Beynon Harris in his guise of John Wyndham. "Let us consider the things that might happen," he says, "not to the inhabitants of Uranus, but to us, our friends, the things we know." And although it may be hard to find a Midwich in these United States, even in New England, it is the quiet plainness of the little village that sets off the enormity of the threat posed by the Children, as the ordinariness of so many of Wells' people made their bizarre adventures the more believable. There is melodrama, but it is a deadly calm melodrama, full of strengthening venom.

I wish that the *Saturday Evening Post* had serialized this as *Collier's* once did the "Triffids." It might have given them a better example of top-rank SF than John Christopher's "Death of Grass," good as that similarly quiet novel was.

THE BEST FROM FANTASY AND SCIENCE FICTION: SEVENTH SERIES, edited by Anthony Boucher. Doubleday & Co., Garden City, N. Y. 1958. 264 pp. $3.75

With the collapse of the Dikty collections there are only two annual anthologies of science fiction and fantasy that we can count on to be excellent. One, of course, is Judith Merril's survey of the entire field for Gnome and Dell. The other, needless to say, is Anthony Boucher's garnering from his own magazine. It's hardly traitorous to say here that *F&SF* is to fantasy *plus* SF what Astounding is to SF alone; the two magazines don't run neck-and-neck, but hand-in-hand.

From where I sit, this is one of the best of these collections since the very first one. Needless to say, it's a deftly handled balance of everything you could want, from a long novelette by Chad Oliver, "Between the Thunder and the Sun," that is a classic of its kind in showing Man's relationship to other races among the stars, and another by Robert F. Young, "Goddess in Granite," that I don't like at all, down to a two-page gag by Isaac Asimov and a slightly longer

and even more memorable one by Fredric Brown . . . and a fifty-four-*letter* horror tale by Ron Smith. But let's spell it out, SF first and then fantasy.

Tops in the book is Oliver's story, which uses his specialty of anthropology about as well as anyone ever has, as he watches a team of anthropologists and ecologists trying to rebuild a broken culture in quiet defiance of galactic law. Next, for biting mood, is Poul Anderson's story of a telepath, "Journey's End." In their company, but entirely different, are Arthur C. Clarke's six storiettes in his "Venture to the Moon" series —recently published in his "Other Side of the Sky"—which add a "White Hart" nip to his best documentary style.

Boucher has a gift—which I am sure he has no intention of imparting to anyone—of discovering unusual feminine talents (of all kinds). Idris Seabright opens this book with "The Wines of Earth," a slight, sentimental, pleasant little tale of the old vintner who is visited by a party of interstellar dilettantes. Mildred Clingerman, while we're at it, casts a chilling shadow over the golden fragrance of the Christmas season with "The Wild Wood," which I trust is fantasy.

But back to our SF, which is more dominant this year than usual. Brown's "Expedition" is a delightful twist on a convention-dinner yarn; Asimov's "A Loint of Paw," is a ditto time-twister that just fails to reach Brown's perfect lightness. In Bertram Chandler's "The Cage," another gag ending is skillfully blown up into a full-scale story of people in an alien zoo, and Will Stanton's "Dodger Fan" is a wry baseball-season variant on the little store that is a ticket office to space. Very lighthearted, this year's selection . . .

The same lightness is in Ward Moore's "Adjustment," in which a disgustingly normal clerk is hired to provide a good example for a happily demented individual, and in "MS. Found in a Chinese Fortune Cookie" by the tragically-lost C. M. Kornbluth—it explains why the once-prolific Cecil Corwin no longer writes. Fritz Leiber has a characteristically unpredictable vignette from the bare edge of fantasy, "The Big Trek," and there is the Young story of an endless, and to me pointless clamber to the top of a mountain shaped like a recumbent woman.

And, by gum, it dawns on me that this top fantasy magazine has next to no fantasy in this collection! Avram Davidson gives us "Mr. Stilwell's Stage," a miniature of justice . . . Mildred Clingerman's Christmas piece I've mentioned . . . Leiber's you can call fantasy, for its treatment . . . and that's it. I've even forgotten another minor SF job, G. C. Edmonson's "Rescue," in which a miner is marooned on Mars. And, for punctuation, a few poems.

This year the *F&SF* collection is *not* representative of the magazine's balanced offering, as it usually is . . . but as I've said, it's better than usual.

SPACE STATIONS, by Willy Ley. Guild Press, Poughkeepsie, N. Y. 1958. 44 pp. $1.00

This is the third in the new series of handsomely illustrated, simple, authoritative books on space flight for children. First and second were "Man-Made Satellites" and "Space Pilots." The artist, John Polgreen, isn't Chesley Bonestell or Mel Hunter, but he is very good and very dramatic. Fine stuff for a convention exhibit, if you can keep the fen from stealing every plate in sight. (I'd be right in there with 'em, behind a green beard and spangled antennae.)

THE VARIABLE MAN, by Philip K. Dick. Ace Books, New York. No. D-261. 255 pp. 35¢

You can take it as axiomatic—unless you object to a strong element of fantasy—that the name of Philip K. Dick on a PB makes it worth every one of the thirty-five cents you spend on it. In fact, the book is likely to be worth more—now, and as an investment—than $3.00 hard-back volumes by better known writers.

This is Dick's first American collection of short fiction. England recognized him first, with "A Handful of Darkness," two years ago. It contains four novelettes and/or short stories and the title story, a "novel" by present magazine standards, but only eighty-six pages long. Most memorable of the lot is the grisly picture of the end of the long war of East and West, when "our" vicious, deadly, self-perpetuating killer-robots turn on all living things. This is "Second Variety." Almost the same theme becomes a completely different story in "Autofac," in which men are struggling to shut down the automatic factories that are stripping the planet of every last resource to supply unneeded commodities for a war-riven race.

The two other shorter stories are also variants of one theme: the hold that psi powers can gain over a civilization. In "The Minority Report," precognitives are used by a crime-prevention police to detect would-be criminals before they can act. But what if their views of the future don't agree? And what if the head of the police finds himself marked down by his own machinery? "A World of Talent," the fourth story, could have stood further development. We're taken to a colonial world run by an utterly weird collection of psi-powerful mutants, jealous of each other and of the normal people back on Earth who would stamp out their variant kind. There is a little boy who hunts strangeness in dark corners—a monster who can span the space between the worlds—a malignant telepath—a jealously precognitive wife. Any or all of them could have been and should have been put into a full-length book.

The title story is more conservative and more formally SF in theme and treatment. Two hundred years from now a dictatorially-united Mankind is

trying to break out of the solar system, through the encircling space navy of the Centaurian empire. Monster computers cast up the odds for and against every proposed move—until a clumsy experiment brings up the "variable" man from 1913. He is an add-jobs man who can do "anything"—the ultimate in non-specialization, with an intuitive knowledge of how things go together and what they should do. And the machines can't figure him into the same matrix with regimented humanity, so that the predictions run wild. It's a Van Vogtian theme, better handled than Van Vogt has done in a long, long while. And it's pure Dick. That's good.

THE WORLD IN SPACE, by Alexander Marshack. Thomas Nelson & Sons, New York & Toronto. 1958. 176 pp. $4.95

By the time you read this, and during the next several months, there will be many books about the International Geophysical Year of July 1957—December 1958. This is one of the first, and the best I have seen so far for someone who wants to get a quick, authoritative picture of what is going on.

Needless to say, the satellites and the program of Antarctic exploration have overshadowed the rest of the IGY program in the press and on TV. You'll soon see how distorted this emphasis is. You may gape a little at the roster of sixty-four participating nations, that includes both Chinas, Ceylon, Ghana, North Korea, Malaya and Indonesia, Rhodesia, Tunisia, and North Viet Nam—the Communist nations are well represented, and their geographical spread will be useful if they file data with the Belgian headquarters. But you'll soon see why this kind of world-wide co-operative program is necessary if we are to have a major break-through in many areas of research.

The illustrations are excellent, but publisher or printer ("I'll fix it if you insist, but you'll never get out on time") has loused up several of them. The amazing pair of rocket photos showing the same identical section of New Mexico, from the same angle, with the strikingly different cloud-covers of spring and summer, should obviously have faced each other. So should the now famous rocket photo of a hurricane swirl over Texas, with the accompanying drawing and the rest of the caption, which are now on successive pages like the first pair. The captions for the six photos of man-made auroras on a model globe are completely mixed up.

I hope that when the returns are all in, the author keeps the same title for a vastly enlarged book with the same organization and excellent presentation, describing what we learn.

SECOND ROUND

THE END OF ETERNITY, by Isaac Asimov. Signet Books, N. Y.

No. S-1493. 1958. 192 pp. 35¢. This novel about the "Eternals" who monitor all Time isn't one of the author's best, but from anyone else it would be very good. The mechanism gets in the way of the story.

THE NAKED SUN, by Isaac Asimov. Bantam Books, N. Y. No. A-1731. 1958. 178 pp. 35¢. This, on the other hand, is one of anybody's best and second only to the earlier future-detective story about Elijah Baley and his partner, R. Daneel Olivaw ("The Caves of Steel").

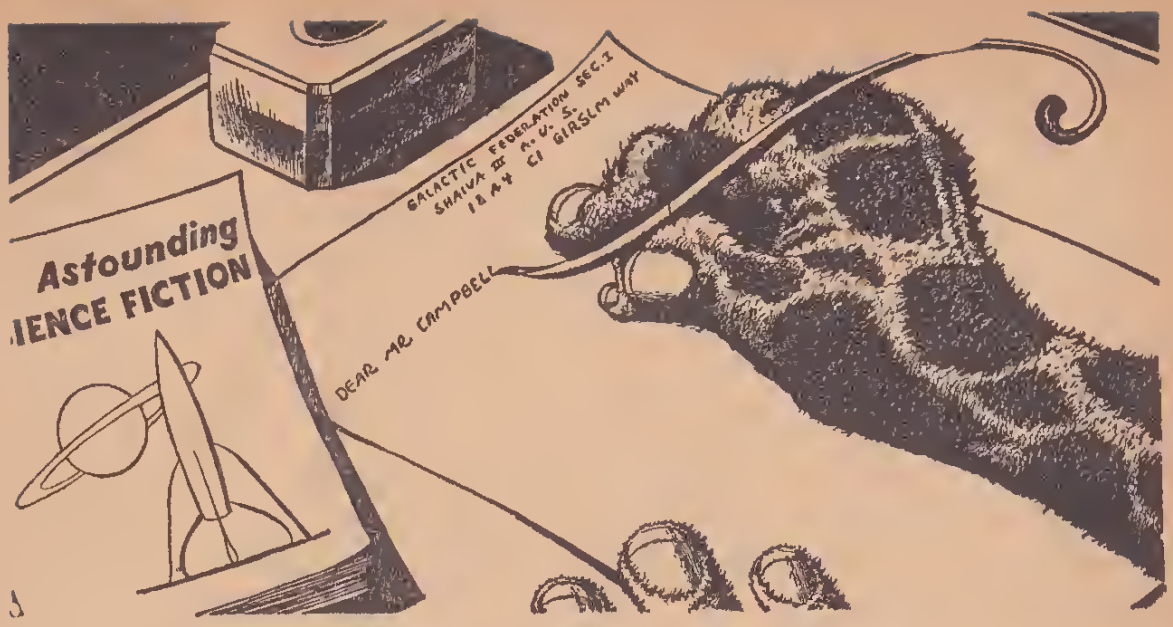
EARTHMAN, COME HOME, by James Blish. Avon Publications, N. Y. No. T-225. 1958. 191 pp. 35¢. These episodes in the history of the flying cities of Deep Space are unfortunately abridged; fortunately, it's been done by the author. The book's even better companion, "Year 2018!" (Avon T-193), is for some obscure reason *not* listed as such in this edition.

BEYOND TIME AND SPACE, edited by August Derleth. Berkeley Books, N. Y. No. G-104. 1958. 174 pp. 35¢. Eight stories from the 1950 anthology, originally published here and elsewhere between 1931 and 1949. Included is one part of Stapledon's "Last and First Men," and A. E. van Vogt's "The Seesaw," which launched his Weapon Shop series. Other authors: Heinlein, Sturgeon, Edmond Hamilton, Clark Ashton Smith, Frank Belknap Long, Donald Wandrei.

THE 27th DAY, by John Mantley. Crest Books, N. Y. No. S-209. 1958. 176 pp. 35¢. A fairish—and fairly literal—movie was made of this unsurprising but competent novel. Saucer people hand a mysterious weapon to five people, two of them from behind the Iron and Bamboo Curtains. They have twenty-seven days in which to decide whether they will wipe out humanity. The gimmick ending is a little too pat and flat.

CITY, by Clifford D. Simak. Ace Books, N. Y. No. D-283. 1958. 255 pp. 35¢. On the back cover, Anthony Boucher says: "A high-water mark in science-fiction writing." On the front, a New York *Herald-Tribune* reviewer, probably also Boucher as "H. H. Holmes," says: "One of the major highpoints of modern science-fiction." I was too cautious: I only said "One of the best books of the science fiction year." On second thought make that *any* year.

THE END



BRASS TACKS

Dear Mr. Campbell:

It has for some time been intellectually unpalatable to me that we should be told that the Universe (?) is rapidly expanding in every direction—that distant stars in every direction are rapidly becoming more distant.

To my poor brain this does not make sense, and I cast about to see whether the observed phenomenon could have any other explanation.

May I offer you a suggestion?

You know how—say in a fast express train—the landscape appears to be rapidly moving across one's scope of vision? Well—take this a step further:

Assume an individual of low-grade intelligence being rapidly propelled through a long, large tube—brightly lit by numerous pin points of light all around the inner surface of the tube. The impression induced by his progress would be that a center spot of light (ahead in the center of his vision) was being swiftly dispersed in spots of light, radially from this center—and if he were unable to face round the other way, the spots of light would cease to be visible when they had dispersed to their maximum.

Let us now assume that Time (the sequence of our events) is the Fourth Dimension, and that we as individuals are rapidly moving along this

Fourth Dimension, though spatially this is not apparent to us other than the following fact, namely that distant stars (like the spots of light in the tube) seem to be rapidly dispersing in *every direction* from our (stationary?) position. This would give us the exact effect of an "expanding universe."

The Universe would *not* be expanding, but would apparently be doing so due to *our* rapid movement in the Fourth Dimension. If we stood still in Time, the expanding phenomenon would cease.

Isn't there some thinking to be done on these lines? If we could *also* travel in a third dimensional direction at the same speed as we are moving in the "Time Direction," the Universe would cease to be expanding in that direction, but would expand at twice the speed in the direction from which we were traveling.

I'm not a scientist—merely an Astounding Science Fiction fan, and am only suggesting there might be something in my proposition. It would give me great pleasure if you could find time to write to me. The world is very small even if the Universe *is* expanding—and friendships are pleasant even when one reaches my age of seventy!—Keith R. Murray, Parton House, Parton, Castle-Douglas, Kirkcuderightshire, Scotland.

You know . . . I like that suggestion! But it has a rather weird implication: in the tunnel analogy, the lights nearest the viewer will appear to move fastest, while those most distant will appear to be nearly motionless. Does this mean that the fastest-moving, most distant nebulae were nearest us in time—though distant in space—while those nearest in space are most distant in time?

Dear John:

The letter by Eldon M. Grupp in the May Astounding raking over force fields restimulated an old chain of conjecture I pursued while driving a Los Angeles freeway. The questions raised in my mind have never been put aside by satisfactory answers.

Driving freeways, as I stated, pointed up the desirability of *force fields for automobiles*. It seems, at first look, a flawless concept. Consider the selfish pleasure of ignoring with impunity the contoured 1958 car that cuts in ten feet ahead at 60 mph. A slight miscalculation on his part and, ah well, that right rear fender of his meets, and succumbs, to my invisible bubble of pure force.

But wait. Let's take this system apart, draw a few free-body diagrams and see how well off I am.

Point One: Since my car must move to be of any use the field must be free of any restraint other than the frame of reference of my car.

Point Two: Upon the contact of my force field with any object (1958 car) in such a manner as to alter the direction of relative motion of that object an equal and opposite force is sustained by the field.

Point Three: Since the field has no mass itself it merely transmits this force to the generating body (my car!).

Conclusion: While my exquisitely formed fenders never undergo physical contact with the intruder, the engagement of the two vehicles across the field will probably result in a near stoppage of both. If I remembered to fasten my safety belt, I should be all right, except the windshield may go and the mounting bolts may shear, sending the engine into the radiator.

Here is my question: Is this a good thing?

Please add to your compilation of Finnagle's Laws a favorite I owe to co-worker William Webber.

"Nature abhors an experimenter."
—William F. Vietinghoff, 20446 Mandell Street, Canoga Park, California.

Perhaps it should be: "Nature abhors a vacuous experimenter"?

Dear Mr. Campbell:

"Research is antisocial" calls for comment. One can agree that Basic Research should be backed by everyone. But Fundamental Research is very different. It all depends that the right fundament be chosen. Some years ago I noted an 1870 experiment in an organic chemistry which sounded interesting yet never had gone further. It may have been outside the trodden path.

In 1927, one of my trade school students mislabeled a bottle. I got unexpected results with it in an experiment. The Army got me a patent on this in 1947, and it points the way to a whole family of new compounds and resins. Five years ago, however, a highly placed group waved me aside because I "had no theory." Yet I had far more than Goodyear when he dropped that mix of rubber and sulphur on the stove, or Fleming, when he became curious about moulds, or Baekland, when he investigated a tarry mess which he should have thrown in the waste can. Schimmelpfennig was right, but he was sent to the nut college and died there. His fundament was basic but unapproved.

My instructor in Organic is now vice president of a great chemical company. He spoke of the benzene ring as a "one ring circus." That made me think—if one ring is interesting, three rings would be far more so. Crude three-ring material may now be bought at $.15/pound in carload lots. Today, one can play with six rings and get new compounds if he so desires. But that might make him unpopular with people. They would not be the result of "research."

Since the Thirties, one has known the result of the breakdown of Lithium Hydride. But what will happen, under similar circumstances, to the hydrides of the other alkali metals? Will we ever be informed?

And by the way—I never went to college. I had fifteen months at a normal school, and three years at an

institute. I never was a college man. As a classroom teacher, I never attended a workshop. Today, more science teachers should attend laboratories, observatories, and green houses, and fewer workshops.

In conclusion, may I quote a paragraph of an Army letter to me in 1943: "In view of the multitude of synthetic resins and waxy materials already known, the proposal does not appear to warrant the filing of a patent application thereon." Since this was The Word, how dared they invent the Epons and others of a later date!—R. E. Bowman, 4309 Fordham Road, Baltimore 29, Maryland.

The results of exsearch are always irrelevant in the sense that they have no known relationship to known theories. The orthodox tend to read "irreverant" for "irrelevant" in that statement unfortunately!

Dear Mr. Campbell:

Enjoyed your May editorial. The pseudo-syllogism about the cat-o'-nine tails starts off with the not necessarily true statement, "Any cat has one more tail than no cat." Since I've seen cats without any tails at all, which, of course, may have been an illusion, it occurred to me that the pseudo-syllogism could be made more "true" by stating it thus:

1. Any cat has one more tail than no cat, except cats without any tails.
2. No cat has eight tails.
3. Therefore, any cat has nine tails, except cats without any tails which only have eight.

Your remarks about research were stimulating. An interesting form of "insearch" is found in the field of human relationships and in the developing of man's potential, in putting in use that of which average man is already capable in the interest of the progress of man.

Average man, however, does not know how much he is capable of doing or being. Only those un-average individuals to whom more of man's possibilities have become evident realize this. Making what is self-evident to the un-average individual obvious to the average man involves a monumental job in communication. The job requires some "exsearch."

Part of the difficulty arises because "Average man" is already snowed under with the problems involving just those abilities to which he thinks he is limited. He is struggling to keep up to the average and worried lest he be considered below average. But man and his abilities do not stand still any more than the various fields of modern man's interests and discoveries stand still. There is a current that carries man along when he allows it to do so. To attempt to accomplish today's job with yesterday's implements would be a serious handicap.

Man himself has progressed and accomplishes more in a day with less physical labor than his ancestors. In

order to progress, man must continually advance his methods of thinking. These must become more analytical—not necessarily along the old ideas of logic, but rather, recognizing where his old logic ceases to be useful and being "ready" by feeling *free* to take off in the direction that is indicated by a more realistic analysis of a situation. This requires some self-observation and acceptance of individual responsibility. General Semantics, Gestalt, the works of Gurdjieff and Ouspensky, Synergetics, Human Engineering and other similar fields have had a favorable influence in helping to lead man in this direction.

The use made of any information, however, rests with the individual man. Average man may move ahead but only as a majority of the individual men do so and many choose to stay behind. I say "choose" because just as in swimming or boating, it takes as much effort or drive to go against the current as it would to go forward more rapidly than the current. It all depends on the *direction* a man chooses to take. Sometimes it may be necessary for man to backtrack a bit, should he find himself in a blind alley. A free man is also *ready* to do this.

Speaking of mottoes, I like this one:

"My mind's made up. Don't confuse me with facts."

We like your magazine — the stories, the articles, the letters sent in by readers and especially your editorials which always get read first. My husband and I have been reading Astounding for a long, long time. Our teen-age daughter now has the bug and it is a struggle to see who gets it first. — Florence Worrell, 13010 Pierce Road, Saratoga, California.

The chief villain among false syllogisms is the one all too many "soft" science people live by:

1. *No true statement can be disproven.*
2. *This statement cannot be disproven.*
3. *Therefore this statement is true!*

Dear John:

I have just been rereading Murray Leinster's "Med Service" in the December Astounding, which I enjoyed very much. However in the second reading I noticed his Med man, Calhoun, had taken fifteen cc. from his tormal and from this blood produced twelve cc. of serum. This was done with only a small quantity of anticoagulant and clumping solution being added.

The tormal's metabolism is said to be very close to man's, and presumably it is a mammalian one. This makes it seem Murray may have overlooked something. A mammal has about forty-five per cent of its blood volume taken up by the red cells. This means from fifteen cc. of blood, there would be about eight and one quarter cc. of serum.

Did Murray overlook this, or have I slipped up? I just happened to think of it as I am studying Medicine myself.—W. John Russell, St. Mark's College, 46 Pennington Terrace, North Adelaide, Australia.

Calhoun must have been watering that serum!

My dear Editor:

E Tama! For once a Maorilander has caught you napping. Page 126 of the January Issue of "Astounding Science Fiction" states: "The consonant sound N. G." can appear only as a terminant.

We Maorilanders can do much better than that; look at the following two words of the names of two well-known places in N.Z. "NGONGAHATA" and "NGARUAWAHIA."

The pronounciation?

Very easy—just use the N.G. as you would at the end of the word sing and carry on with the rest of the word. This will show you that you can use the N.G. both as an initial consonant and a medial consonant. Similarly with F.R.— This can be a final consonant in Arabic, the only point is that a vowel is implied between the F. & R. Even if I should be wrong I do know something about our Maori pronounciation.

Best of wishes and many thanks for many happy hours of quiet relaxation.—G. F. Joseph.

There are many languages in the world that do use ng as an initial consonant; evidently Maori belongs to that group. But English does not. Welsh uses gw as an initial consonant, and it has been adopted by English in such names as Gwen. But English itself does not use the gw sound as an initial, nor the ng.

Dear Mr. Campbell:

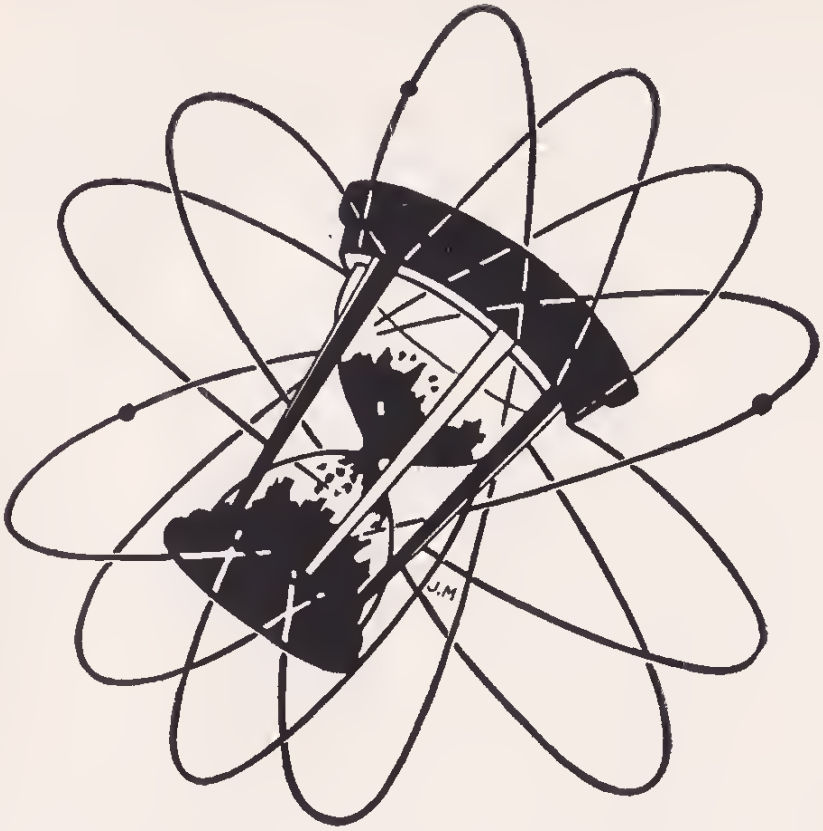
I found "Portrait of You," in the May issue very interesting, however there was one item in your statistical rundown that completely baffles me.

I am referring to the .8% of your readers who have been reading Astounding for a period of from 29 to 40 years. Checking back on my complete collection which ranges back to the first Clayton issue dated January 1930, I find that Astounding celebrated its 28th birthday in January 1958.

Now how is it possible for .8% of your readers to have been reading Astounding for from 29 to 40 years when it has only been published for 28 years?—E. K. Hayward, 131 Stanmore Road, Baltimore 12, Maryland.

The answer is obvious! Since Astounding never makes mistakes, or typographical errors, we are simply revealing that some of our readers actually began reading on an alternative time-track in which ASF started with the January, 1908 issue.

We Have Time Machines for Sale—



simple little machines of paper and ink, tubes and wires, that coupled with your own mind can soar down the years of Eternity.

LIVE—in a million could-be years, on a thousand may-be worlds.

ASTOUNDING Science Fiction offers you this and more . . .

We know you wan't want to miss a single issue once yau've read *ASTOUNDING Science Fiction*, the award-winning Science Fictian magazine. Sa . . . to learn of the fascinating warld af tamarraw, subscribe taday ta . . .

ASTOUNDING Science Fiction

Fill Out and Mail Order Form Below

Subscription Department, ASTOUNDING SCIENCE FICTION
304 East 45th Street, New York 17, New York.

Enter my subscription to ASTOUNDING SCIENCE FICTION for 12 issues at $3.50. I will save 70¢ compared with the newsstand rate of $4.20 for the same 12 issues. (U. S. and Possessions only.)

☐ Check ☐ Money Order ☐ Cash ☐ New Subscription ☐ Renewal

NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

Start my subscription with the _____ issue. ASF 9-58

GET READY FOR THE SPACE ERA! SEE THE SATELLITES . . . THE MOON ROCKETS

AMAZING TELESCOPE BUYS

AND OTHER OPTICAL BARGAINS

See the Stars, Moon, Planets Close Up!

3" Astronomical Reflecting Telescope

(Famous Mt. Polomor Type)

60 to 160 Power—An Unusual Buy!

PHOTOGRAPHERS!
Adapt your camera to this Scope for excellent Telephoto shots and fascinating photos of moon!

Assembled—Ready to Use!

You'll see the Rings of Saturn, the fascinating planet Mars, huge craters on the Moon, Star Clusters, Moons of Jupiter in detail. Galaxies! Equatorial mount with lock on both axes. Aluminized and overcoated 3" diameter high-speed f/10 mirror. Telescope comes equipped with a 60X eyepiece and a mounted Barlow Lens, giving you 60 to 160 power. Low-cost accessory eyepiece available for power up to 320. An Optical Finder Telescope, always so essential, is also included. Sturdy, hardwood, portable tripod.

Free with scope: Valuable STAR CHART and 272-page "Astronomy Book."

Stock No. 85,050-A.....$29.50 f. o. b.

(Shipping wt. 10 lbs.) Barrington, N. J.

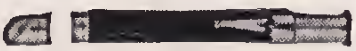
4¼" ASTRONOMICAL TELESCOPE

Mt. Palomar type. Up to 270 power. A fine Reflector Telescope complete with real Equatorial Mount and Tripod and 6X Finder. Aluminum tube. 4¼" diameter mirror, rack and pinion focusing eyepiece holder, 2 eyepieces and mounted Barlow Lens for 40X, 90X, 120X, and 270X. Low-cost accessory eyepiece available for power up 540.

Stock No. 85,006-A....complete....$74.50 f. o. b.

(Shipping weight approx. 25 lbs.) Barrington, N. J.

New! 2-in-1 Combination Pocket-size 50-Power MICROSCOPE and 10-Power TELESCOPE



ONLY $4.50 Postpaid

Useful Telescope and microscope combined in one amazing precision instrument. Imported! No larger than a fountain pen. Telescope is 10-Power. Microscope magnifies 50 times. Sharp focus at any range. Handy for sports, looking at small objects, just plain snooping.

Send Check or M. O.
Satisfaction Guaranteed

Order Stock No. 30,059-A.....$4.50 Postpaid

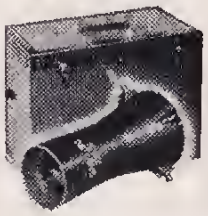
Watch the Satellites through this

7x50 MONOCULAR

This is fine quality, American-made Instrument — war surplus! Actually ½ of U. S. Govt. 7 x 50 Binocular. Used for general observation both day and night and to take fascinating telephoto shots with your camera. Brand new. $95 value. Due to Japanese competition we close these out at a bargain price. Directions and mounting hints included.

Stock No. 50,003-A.....$15.00 Postpaid

SALE! TERRIFIC WAR SURPLUS BARGAIN!



AERIAL CAMERA LENSES

Government Cost $1218—
Now Low as $39.50 Used

Made by B & L and E. K. 24" F.L. f/6, in 23" long Lens Cone. Use as long range. Big Bertha Telephoto lens—for Richest field (wide field, low power) telescope, etc. Lenses are 4" dia.—precision 4-element type. Aero Tessar and Aero Ektar (no choice). Easily removed. Diaphragm (f/6 to f/22) is included. Opens approx. 1" to 3½". Lens and cone—wt. 25 lbs. Sturdy carrying trunk—wt. 26 lbs.

Stock No. 85,059-A 24" used Price $39.50 f. o. b. Utah
Stock No. 85.060-A 24" new Price $59.50 f. o. b. Utah

SALE! WIDE-ANGLE ERFLE EYEPIECE

1½" f. l.! Focusing metal mount is 2 11/16" in diameter. Consists of 3 coated achromats. 65° field. Gov't cost over $100. Use these with the 24" f. l. Aerial Camera Lenses to make a 16-power wide field telescope, etc.

Stock No. 50,178-A.....Only $9.95 Postpaid

BEGINNER'S LENS KITS!

Fun for adults! Fun for children! Kits include plainly written, illustrated booklet showing how you can build lots of optical items.

Stock No. 2-A—10 lenses.....$1.00 Postpaid
Stock No. 5-A—45 lenses.....$5.00 Postpaid

INSTRUCTION BOOKLETS

	Stock No.	Postpaid
How to Build Projectors.....	9014-A	30¢
Homebuilt Telescopes.....	9006-A	40¢
ULTRA CLOSE-UP Photography	9042-A	60¢
Fun With Optics.....	9050-A	50¢
Solar Energy & Solar Furnaces..	9053-A	40¢

Get FREE CATALOG A

America's No. 1 source of supply for experimenters, hobbyists. World's largest variety of Optical Items. Bargains galore. . . . War surplus—Imported — Domestic! Microscopes, Telescopes, Satellite Telescopes, Infrared sniperscopes and parts, Prisms, Lenses, Reticles, Mirrors and dozens of other hard-to-get Optical Items.

WRITE FOR
FREE CATALOG A

ORDER BY STOCK NUMBER . SEND CHECK OR MONEY ORDER . SATISFACTION GUARANTEED!

EDMUND SCIENTIFIC CO., BARRINGTON, N. J.